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Original Research Article

Comparative study of efficacy of dexmedetomidine and propofol for sedation in intensive care unit

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ABSTRACT

Background: Sedation is a crucial requirement for all patients in the intensive care unit (ICU). It enhances patient comfort, aids in reducing anxiety, stabilizes vital signs and shortens the discharge from the ICU.
Methods: A total of 60 patients randomized into group D and group P of 30 each. Group D received 1 mcg/kg/10min dexmedetomidine as loading dose and 0.2-0.7 mcg/kg/hour as maintenance dose. Group P received 1mg/kg propofol as loading dose followed by an infusion of 25-75 mcg/kg/hr as maintenance dose. Patient's heart rate (HR), blood pressure, Ramsay sedation score (RSS) and visual analogue scale (VAS) were monitored and recorded all through the ICU stay.
Results: Study shows that, there was no significant difference with regard to age, sex, weight in both the groups. The mean HR at various time intervals did not show statistical significance; however, the reduction in HR was more in group D compared to group P. We found that the differences in mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) at different time intervals were not statistically significant. In overall group D showed significantly higher ($p<0.0001$) RSS score after 1 hour, 2 hours, 6hours after sedation compared to group P. Furthermore, the mean VAS score was significantly lower in the group D compared to the group P.
Conclusions: Dexmedetomidine has been identified as a superior option for sedation in the intensive care unit when compared to propofol.

Keywords: Dexmedetomidine, Propofol, Intensive care unit sedation, Blood pressure, Heart rate

INTRODUCTION

Critically ill patients in an intensive care unit are exposed to various noxious stimuli including postoperative pain, multiple venipunctures, invasive monitoring, and endotracheal intubation; therefore, they are usually treated with a continuous infusion of sedatives.[1] The society of critical care medicine (SCCM) has advised the utilization of non-benzodiazepine agents, such as propofol and dexmedetomidine for sedation regimen.[2] The transition from benzodiazepines to non-benzodiazepines is supported by recent findings indicating that, the use of benzodiazepines is an independent risk factor for the onset of delirium, prolonged hospital length of stay (LOS) and elevated mortality rates at six months.[3]

Propofol is employed in intensive care unit as a sedative due to its rapid onset and offset, along with its brief duration of action. However, certain factors restrict its use, including hemodynamic instability, such as hypotension and bradycardia, along with its absence of analgesic properties.[4] Dexmedetomidine acts as a strong agonist for the alpha-2 adrenoceptors. It serves as an effective sedative and diminishes requirement for opioids due to its notable analgesic properties.[5] An optimal sedative must ensure a swift onset of action and a quick recovery, possess a low

potential for accumulation, and result in no withdrawal symptoms. Additionally, it should be easily titratable and maintain hemodynamic stability without disruption.[6]

This research aims to evaluate the safety and effectiveness of two medications, dexmedetomidine and propofol, in terms of sedation quality, hemodynamic stability and the need for additional analgesics in postoperative patients within the intensive care unit.

METHODS

Study design

It was a prospective, randomized, double blinded and comparative study.

Study sample

This prospective study included 60 patients, regardless of sex, between the ages 18 to 60 years admitted in ICU. The computerized randomized table was used to randomly assign 30 patients of any sex to dexmedetomidine (Group D) or propofol (Group P) groups.

Study site

The current study is a single-center, hospital-based investigation in the department of anaesthesia, MGM hospital, Warangal during the period of 2019-2021.

Inclusion criteria

The study includes patients of age between 18-60 years either of gender, who require immediate sedation to permit initiation and tolerance of mechanical ventilation.

Exclusion criteria

Study excludes patients with known/suspected allergy/intolerance to dexmedetomidine and propofol, pregnancy, acute unstable angina and acute myocardial infarction.

Upon receiving approval from institutional ethical committee, the entire procedure was thoroughly explained to patients and informed written consent was taken. Patient enrolled in the study divided into group D and P of 30 each.

Group D

Patient randomized received a loading dose of dexmedetomidine 1 mcg/kg/10 minutes followed by a maintenance infusion of 0.2-0.7 mcg/kg/hr.

Group P

Patients randomized received a loading dose of 0.5 to 1 mg/kg then an infusion of 25 to 75 mcg/kg/min.

During the period of sedation, patients HR and blood pressure were monitored at baseline and after loading dose administration at intervals of 30 min, 1 hour, 2 hours, 6 hours, 12 hours, 18 hours, 24 hours. The RSS and VAS scores were recorded after sedation at an interval of 30 min, 1 hour, 2 hours, 6 hours, 8 hours, 12 hours and 24 hours.

Statistical analysis

Statistical analysis was performed using the graph pad quick calculation software. The patient demographics were analyzed using analysis of variance (ANOVA) for comparison purposes. The study data were analyzed using mean, standard deviation, paired student's "t" test (for values within the group at different time stations) and independent unpaired "t" test (for comparison of intergroup values).

RESULTS

The demographic findings presented in Table 1 indicate that the mean age of participants in group D was 35.5 years, while in group P it was 40.2 years. Additionally, the average weights of the patients were recorded as 66.1 kg for group D and 68.5 kg for group P. No statistically significant differences in age or weight were observed between the two groups. Out of 60 cases, 65% were male and 35% were female, with no significant difference between the two groups (p=0.868).

Table 2 displays the variations in SBP and DBP before and after sedation at various time points in groups D and P. The baseline values of SBP and DBP were comparable with no significant difference. Following the infusion mean SBP and mean DBP was found decreased consistently in both the groups. Compared with group D, mean SBP and mean DBP was significantly lower in group P ($p<0.0001$).

Table 3 explains the changes in RSS and VAS scores after sedation at different time intervals in group D and group P. Mean RSS after sedation after 30 min, 12 hours, 24 hours were comparable between the two groups with no significant difference (p=0.52). Whereas mean RSS after 1 hour, 2 hours, 6 hours of post sedation was significantly higher in group D, compared to group P ($p<0.0001$). the two group's mean VAS was similar at every time point, with the exception at 30 minutes after infusion, when group D VAS was significantly lower than group P ($p<0.05$).

Table 4 demonstrated that changes in HR before sedation and post sedation at different time intervals in group D and group P. Baseline Mean HR among two groups was comparable with no significant difference. Following the initiation of the infusion, the mean HR dropped consistently in both the groups. Compared to group P, group D experienced a more notable drop-in mean HR ($p<0.05$).

Table 1: Age, weight and gender distribution among study groups.

Variables	Group D	Group P	P value
Male	20	19	0.868
Female	10	11	
Mean age (in years)	35.5±14.7	40.2±13.4	0.329
Weight (kg)	66.1±7.7	68.5±5.4	0.303

Table 2: Comparison of SBP and DBP among two groups.

Variables	SBP		P value	DBP		P value
	Group D	Group P		Group D	Group P	
Before sedation	129.64	127.13	0.39	80.3	80.4	0.8
30 min after sedation	114.2	104.5	<0.0001	69.4	68.1	<0.0001
1 hour after sedation	120.8	110.6	<0.0001	71.1	60.2	<0.0001
2 hours after sedation	118.6	108.4	<0.0001	68.5	59.4	<0.0001
6 hours after sedation	110.3	102.8	<0.0001	67.6	57.7	<0.0001
12 hours after sedation	111.3	102.2	<0.0001	65.5	56.7	<0.0001
18 hours after sedation	110.6	101.8	<0.0001	61.1	58.2	<0.0001
24 hours after sedation	111.6	100.6	<0.0001	62.8	58.2	<0.0001

Table 3: Comparison of RSS and visual analogue scale among two groups.

Variables	RSS		P value	VAS		P value
	Group D	Group P		Group D	Group P	
30 min after sedation	1.5	1.4	0.5	1.71	3.3	0.0004
1 hour after sedation	2.9	1.7	<0.0001	1.78	2.25	0.14
2 hours after sedation	3.0	2.1	<0.0001	2.0	2.45	0.24
6 hours after sedation	3.2	2.5	<0.0001	2.35	2.45	0.77
12 hours after sedation	2.6	2.3	0.04	2.16	2.55	0.10
24 hours after sedation	2.3	2.06	0.004	2.48	2.55	0.78

Table 4: Comparison of HR among two groups.

Variables	HR		P value
	Group D	Group P	
Before sedation	97.9	98.8	0.7
30 min after sedation	67.7	81.9	<0.0001
1 hr after sedation	85.5	102.66	0.002
2 hr after sedation	86.7	101.6	0.006
6 hr after sedation	64.06	81.2	<0.0001
12 hr after sedation	62.5	82.5	<0.0001
18 hr after sedation	61.73	82.7	<0.001
24 hr after sedation	61.2	82.1	<0.0001

DISCUSSION

Adequate sedation and analgesia in the ICU are essential need of every patient. Anger et al highlighted the importance of sedation therapy and pain management as critical factors of improved ICU outcomes and research has spurred the advancement of novel sedatives and sedation protocols tailored for ICU settings. Nevertheless, the quest for the optimal sedative for use in the ICU continues, despite considerable progress in this area.[7] In current study, we have evaluated dexmedetomidine infusion as a sedative agent in the ICU and compared it to propofol infusion.

The present single-centric investigation revealed that the average age does not exhibit a significant difference between the two groups (0.329). These results align with the studies conducted by Jakob et al which also reported no statistical significance in age among three groups (p>0.05).[8] Furthermore, Elgebaly et al similarly observed no age difference between the two groups.[9]

In the current study, the sex ratio (male: female) is observed to be 20:10 in the group D (dexmedetomidine group) and 19:11 in the group P (propofol group). A study by Rashwan et al involved a total of 90 patients, revealing a sex ratio of 20:10 in the dexmedetomidine group and

19:11 in the propofol group, indicating that the sex distribution aligns closely with the findings of our current study.[10]

In the research carried out by Paliwal et al involving 60 patients, the initial mean arterial pressure (MAP) was found to be similar across both groups. However, a notable decrease in MAP was recorded after the administration of a loading dose of propofol. This observation aligns with the results of our study, which also demonstrated a significant reduction in SBP and DBP following the infusion of propofol ($p<0.001$).[11]

In our research, we observed that the differences in mean HR across various time intervals were not statistically significant on comparing group D and P. Notably, HR decreased more significantly in group D, resulting in a lower mean HR. These findings align with the study conducted by Esmaoglu et al which examined 40 patients with eclampsia on mechanical ventilation, demonstrating that dexmedetomidine leads to a greater reduction in HR compared to midazolam within the first 24 hours.[12] Additionally, similar outcomes were reported by Rashid et al who compared midazolam, propofol, and dexmedetomidine in post-operative eclamptic patients.[13]

Throughout the majority of the time intervals, both group D and P maintained a mean RSS ranging from 2 to 3 and 2 to 2.5 respectively in our study. This outcome aligns with the research conducted by Sharma et al which reported that the RSS was comparable, consistently maintaining a mean score of 2 to 3 across most time intervals in both groups.[14] Prerana et al indicated that the mean RSS ranged from 2 to 4 for the dexmedetomidine group and from 2 to 3 for the propofol group.[15] We also observed mean RSS was more (2 to 3) in group D (dexmedetomidine group) compared to group P (propofol group) (2 to 2.5). In the study conducted by Raafat et al the VAS scores for the dexmedetomidine group were notably lower compared to those in the propofol group suggesting a reduced need for analgesic medications in dexmedetomidine group compared to propofol group.[16] Our findings regarding VAS scores are consistent with this research.

CONCLUSION

In conclusion, dexmedetomidine is an excellent option for sedation in the ICU to traditional sedatives such as propofol and benzodiazepines. A key benefit of dexmedetomidine is its ability to provide 'conscious sedation' without causing significant respiratory depression and facilitates earlier patient discharge. Additional advantages of dexmedetomidine include its ability to maintain hemodynamic stability, reduce the need for analgesics, and offer greater cost-effectiveness.

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REFERENCES

1. Lonardo NW, Mone MC, Nirula R, Kimball EJ, Ludwig K, Zhou X, et al. Propofol is associated with favorable outcomes compared with benzodiazepines in ventilated intensive care unit patients. Am J Respir Crit Care Med. 2014;189(11):1383-94.
2. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med. 2013;41(1):263-306.
3. Shehabi Y, Riker RR, Bokesch PM, Wisemandle W, Shintani A, Ely EW. SEDCOM (Safety and Efficacy of Dexmedetomidine Compared with Midazolam) Study Group. Delirium duration and mortality in lightly sedated, mechanically ventilated intensive care patients. Crit Care Med. 2010;38(12):2311-8.
4. Roberts RJ, Barletta JF, Fong JJ, Schumaker G, Kuper PJ, Papadopoulos S, et al. Incidence of propofol-related infusion syndrome in critically ill adults: a prospective, multicenter study. Crit Care. 2009;13(5):R169.
5. Devlin JW, Lau AK, Tanios MA. Propofol-associated hypertriglyceridemia and pancreatitis in the intensive care unit: an analysis of frequency and risk factors. Pharmacotherapy. 2005;25(10):1348-52.
6. Coursin DB, Maccioli GA. Dexmedetomidine. Curr Opin Crit Care. 2001;7(4):221-6.
7. Anger KE, Szumita PM, Baroletti SA, Labreche MJ, Fanikos J. Evaluation of dexmedetomidine versus propofol-based sedation therapy in mechanically ventilated cardiac surgery patients at a tertiary academic medical center. Crit Pathw Cardiol. 2010;9(4):221-6.
8. Jakob SM, Ruokonen E, Grounds RM, Sarapohja T, Garratt C, Pocock SJ, et al. Dexmedetomidine vs midazolam or propofol for sedation during prolonged mechanical ventilation: two randomized controlled trials. JAMA. 2012;307(11):1151-60.
9. Elgebaly AS, Sabry M. Sedation effects by dexmedetomidine versus propofol in decreasing duration of mechanical ventilation after open heart surgery. Ann Card Anaesth. 2018;21(3):235-242.
10. Rashwan S, El moutaz Mahmoud H, Taha Z. Safety and Efficacy of Dexmedetomidine, Ketofol, and Propofol for Sedation of Mechanically Ventilated Patients. J Intensive Crit Care. 2018;4(4):16.
11. Paliwal B, Rai P, Kamal M, Singariya G, Singhal M, Gupta P, et al. Comparison Between Dexmedetomidine and Propofol with Validation of Bispectral Index for Sedation in Mechanically Ventilated Intensive Care Patients. J Clin Diagn Res. 2015;9(7):UC01-5.
12. Esmaoglu A, Ulgey A, Akin A, Boyaci A. Comparison between dexmedetomidine and midazolam for sedation of eclampsia patients in the intensive care unit. J Crit Care. 2009;24(4):551-5.
13. Rashid MR, Najeeb R, Mushtaq S, Habib R. Comparative evaluation of midazolam,

dexmedetomidine, and propofol as Intensive Care Unit sedatives in postoperative electively ventilated eclamptic patients. J Anaesthesiol Clin Pharmacol. 2017;33(3):331-6.
14. Sharma SK, Ahmad S, Jamir Z, Kumar S, Priyanka D, Narendra D, et al. A study of efficacy of dexmedetomidine and midazolam for sedation of eclamptic patients on mechanical ventilation in ICU. J. Evolution Med. Dent. Sci. 2017;6(30):2415-8.
15. Shah PN, Dongre V, Patil V, Pandya S, Mungantiwar A, Choulwar A. Comparison of post-operative ICU sedation between dexmedetomidine and propofol in Indian population. Indian J Crit Care Med. 2014;18(5):291-6.
16. Salem RA, Mohamed AA, Moghazy, Alsagheer GA. A comparative study between dexmedetomidine and propofol in combination with fentanyl for conscious sedation during extracorporeal shock wave lithotripsy. Egypt J Anaesth. 2016;32(1):1-6.

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