Original Article

OPEN ACCESS

Comparison of Dexmedetomidine and Propofol Among Mechanically Ventilated Postsurgical Patients

Syed Wahaj Uddin[1], Syed Saqib Ali[2], Nimrah Farook[3], Bilal Rasool[4], Qamar Zaman Phull[5], Shujaullah Talib[6]

[1-3]Consultant Anesthetic, Sindh institute of urology and transplant, Karachi, [4]Assistant Professor, Department of General Surgery, Liaquat University of Medical & Health sciences Jamshoro/Hyderabad, [5]Assistant Professor of Pharmacology, Bilawal Medical College for Boys LUMHS Jamshoro, [6]Assistant Professor of Pharmacology, Muhammad Medical College Mirpur Khas, Pakistan.

Author`s Contribution

[1,2]Substantial contributions to the conception or design of the work; or the acquisition, [4,6]Active participation in active methodology, [2,3]analysis, or interpretation of data for the work, [5]Drafting the work or revising it critically for important intellectual content

Funding Source: None
Conflict of Interest: None

Received: Nov 28, 2023
Accepted: May 28, 2024

Address of Correspondent
Dr Syed Wahaj Uddin
Consultant Anaesthesia, Sindh institute of urology and transplant

ABSTRACT

Objective: To compare the outcome of dexmedetomidine and propofol among mechanically ventilated postsurgical patients.

Methodology: A Comparative Study was conducted at Department of Anesthesia, Abbasi Shaheed Hospital, Karachi, during Six months from January 2020 June 2020. Postsurgical patients requiring mechanical ventilation admitted to Surgical ICU for 24 hours or more, aged 30-60 years and of either gender, were included. The participants were divided in to two groups. Group A Dexmedetomidine and group B Propofol. Comparison between both groups for mean systolic blood pressure at 24 hours was done using independent t-test. Effect modifiers like age, gender, diabetes and hypertension were addressed through stratification taking a p-value ≤0.05 as significant.

Results: A total of 60 patients (30 in dexmedetomidine and propofol groups) were included in this study. Mean age in the in dexmedetomidine group was 51.25 ±7.91 years with 17 (56.7%) and 13 (43.3%) of patients were male and female respectively. Mean age in the propofol group was 52.71±8.01 years with 16 (53.3%) and 14 (46.7%) of patients were male and female respectively. Mean SBP at 24 hours in the dexmedetomidine and propofol group was 117.26±14.37 and 111.40±11.15 respectively. P-value was 0.08.

Conclusion: Study revealed that the both dexmedetomidine and propofol observed to be the effective for postoperative analgesia, sedation in addition to systolic blood pressure stability at 24 hours.

Keywords: Dexmedetomidine, propofol, mechanically ventilated and postsurgical patients.

Cite this article as: Soomro M, Bhutto M, Kumar P, Bajkani N, Memon ZH, Bhatti R. Hepatocellular Carcinoma In Cirrhotic Patients With Hepatitis-C Virus Positive Patients Ann Pak Inst Med Sci. SUPPL-1 (2024): 469-473. doi. 10.48036/apims.v20iSUPPL-1.1165

Introduction

Patients in the intensive care unit (ICU) frequently endure pain, agitation, and anxiety, along with undergoing invasive monitoring, procedures, or mechanical ventilation. Consequently, providing proper analgesia and sedation is crucial.[1] However the sedation in the intensive care unit (ICU) is to ensure patients remain comfortable, tranquil, and free from pain.[2] Inadequately managed pain and agitation have been linked to the deterioration of the critical condition, heightened sympathetic tone, and a higher incidence of accidental removal of medical devices like vascular catheter endotracheal tube.[1,3,4] Different regimens of analgesic and sedative drugs have been employed for patients needing mechanical ventilation. The Society of Critical Care Medicine advises using either dexmedetomidine or propofol for sedation, aiming for light sedation levels in adults undergoing mechanical ventilation and continuous sedation.[5]

In healthcare settings, the most widely used sedative is dexmedetomidine.[6,7] This medication, a particular agonist of α2-adrenergic receptors, works by activating these receptors to block the production of thyroxine, which lowers nervous system activity.[6] Participants undergoing dexmedetomidine anesthesia did not exhibit respiratory

depression, which makes it advantageous for those who are having ventilator failures.[6] The alpha-2 agonist dexmedetomidine has sedative and analgesic properties and is approved for ICU sedation for up to 24 hours. It causes only mild cognitive impairment, facilitating easy communication between healthcare providers and patients in the ICU. Additionally, it helps reduce ICU stay costs and supports more natural weaning from mechanical ventilation.[8,9] On the other hand, the Propofol is an effective, short-acting agent used for ICU sedation, but it has adverse effects including respiratory destress, low blood pressure, lactic acidosis, hypertriglyceridemia, propofol infusion syndrome,[10] and potentially even apnea, depending on the infusion dosage used.[11] Additionally, since propofol lacks analgesic properties, postsurgical patients requiring mechanical ventilation would also need opioids.[10] Propofol is also formulated in a lipid-based emulsion, which can lead to hypertriglyceridemia with prolonged use. While propofol has favorable pharmacokinetic properties for short-term sedation, its side effects may render it an unsuitable option for certain patients.[12] Although substantial developments in technology, procedures, and medical care have resulted to decreased levels of severe complications and death, there remains a requirement for perioperative medications that is simultaneously safe and efficient in order to reduce these adverse occurrences. Furthermore, some studies support the use of such drugs, reporting that both drugs are equally effective.[13-15] However, considering the controversies and the lack of adequate local evidence, this study has been conducted to observe the comparative outcomes of Dexmedetomidine and propofol among mechanically ventilated postsurgical patients.

Methodology

A comparative study was conducted at Department of Anesthesia, Abbasi Shaheed Hospital, Karachi. Study was conducted during a period of six months from January 2020 June 2020. Non-probability consecutive sampling technique was used. All the postsurgical patients of lower limb or abdominal surgeries requiring mechanical ventilation admitted to Surgical ICU for 24 hours or more, aged 30-60 years and of either gender, were included. All the patients with comorbidities like chronic obstetric pulmonary disease (COPD), chronic kidney disease (CKD) and acute coronary syndrome (ACS) were excluded. Patients those were not agreeing to participants in the study were also excluded. Approval from Research Evaluation Unit (REU) of College of Physician and Surgeon of Pakistan and ethical review board was obtained prior to the conduct of the study. Patients meeting the inclusion criteria were offered to be a part of the study. Before enrolment, the pros and cons of the study were explained and informed consent was taken from attendants of patients admitted in ICU post-surgery and on mechanical ventilation. The participants were divided in to two groups by sealed opaque envelop methods. A person not involved in the research was asked to pick one envelop and the two groups group A Dexmedetomidine and group B Propofol were formed accordingly. At the end of 24 hours on mechanical ventilation, SBP was noted. This information along with age, gender, history of diabetes and hypertension was entered in the proforma. Data was analyzed by using SPSS version 21. Mean and standard deviation was calculated for age and SBP at 24 hours since on mechanical ventilation. Frequency and percentages were calculated for gender, history of diabetes and hypertension. Comparison between both groups for mean systolic blood pressure at 24 hours was done using independent t-test. Effect modifiers like age, gender, diabetes and hypertension were addressed through stratification. Post stratification independent t-test was applied. P-value ≤ 0.05 was taken as significant.

Results

According to age in the both groups, 40% of patients were aged 20-45 years, while the remaining 60% were aged 46-60 years. There were 56.7% were male in Dexmedetomidine group, and 43.3% were female. Similarly, in the Propofol group, 53.3% were male, and 46.7% were female. Diabetes mellitus is slightly higher in the Propofol group, where 43.3% (13 patients) have diabetes, compared to 36.7% (11 patients) in the Dexmedetomidine group. 33.3% patients of the Dexmedetomidine group have hypertension, compared to 30% (9 patients) in the Propofol group. The majority of patients in both groups do not have diabetes and hypertension. Table I

Table I: Demographic and clinical characteristics of the patients. (n=60)

Variables		Dexmedetomidine Group (N=30)	Propofol Group (N=30)
Age groups (years)	20-45	12 (40%)	12 (40%)
	46-60	18 (60%)	18 (60%)
Gender	Male	17 (56.7%)	16 (53.3%)
	Female	13 (43.3%)	14 (46.7%)
Diabetes Mellitus	Yes	11 (36.7%)	13 (43.3%)
	No	19 (63.3%)	17 (56.7%)
Hypertension	Yes	10 (33.3%)	09 (30%)
	No	20 (66.7%)	21 (70%)

Overall mean of systolic blood pressure was 117.2 mmHg in dexmedetomidine group and 111.4 mmHg in Propofol group (p->0.001). Figure 1

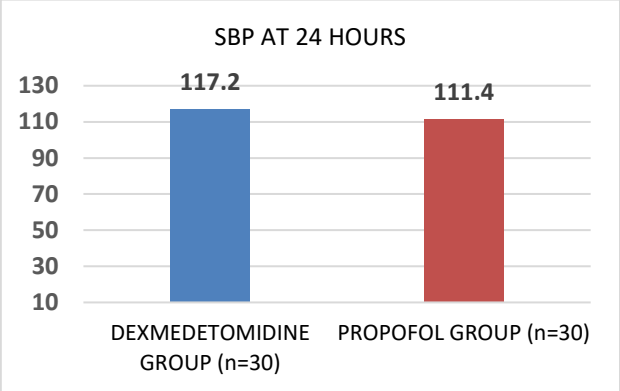

Figure 1. Overall average of SBP among both study groups at 24 hours. (n=60)

On the stratification the Dexmedetomidine group had higher SBP values compared to the Propofol group in several subgroups, with statistically significant differences observed in younger patients (20-45 years) and non-diabetic patients (p-<0.05), while its was statistically insignificant basis on gender (>0.05). Table II

Table II: Comparison of SBP at 24 hours among both groups. (n=60)

Variables		SBP AT 24 HOURS		p-value
		Dexmedetomidine group (N=30)	Propofol group (N=30)	
Age groups (years)	20-45	120.16±13.18	107.91±12.78	0.03
	46-60	115.33±15.16	113.72±9.60	0.70
Gender	Male	113.70±13.29	108.81±10.83	0.25
	Female	121.92±14.90	114.35±11.16	0.14
Diabetes mellitus	Yes	111.90±11.13	112.84±11.23	0.83
	No	120.36±15.37	110.29±11.31	0.03
Hypertension	Yes	130.7±11.23	119.55±12.51	0.05
	No	110.55±10.63	107.90±8.67	0.38

Discussion

Sedation is frequently required by individuals having assisted mechanical ventilation to increase tolerance to the endotracheal tube and promote adaptation to the ventilator, lowering stress reaction, discomfort and the anxiety.[13] Using sedation to maximize patient-ventilator interactions may decrease prolonged MV and ICU hospitalizations, as well as the likelihood of needing a tracheostomy.[13] The present study evaluated the comparative outcomes of dexmedetomidine and propofol among mechanically ventilated postsurgical patients, comprising a total of 60 patients (30 in each group), with a mean age of 51.25 ± 7.91 years in the dexmedetomidine group, of which 17 (56.7%) were male and 13 (43.3%) were female, and a mean age of 52.71 ± 8.01 years in the propofol group, with 16 (53.3%) males and 14 (46.7%) females. In the comparison of this study Wanat M et al[12] reported that the mean age of patients in dexmedetomidine group was 63 ±14.1 years and in propofol group was 68 ±11.2 years, furthermore in aligns to this study they found males in majority in both groups as 25 (75.8%) dexmedetomidine group and 225 (70.5%) in propofol group.[12] In the study by Ysenbaardt B et al[14] also reported that the males were in majority in both groups as 81.1% in dexmedetomidine group and 83.9% in without dexmedetomidine group, while they found slightly higher mean age of the patients in both groups in their study. However, another study by et al[15] reported a lower mean age in both groups compared to our findings, with the dexmedetomidine group averaging 37.7 ± 10.5 years and the normal saline group averaging 40.6 ± 12.0 years The difference in mean age may be attributed to the sample selection criteria employed for surgeries and the age range considered in the studies.

In this study the mean SBP at 24 hours in the dexmedetomidine and propofol group was 117.26±14.37 and 111.40±11.15 respectively, the p-value was near to significant 0.08. Consistently Białka S et al[16] reported that the main results of their study indicated that while there were no significant differences in heart rate, SBP, and mean arterial blood pressure between the groups (P = >0.05), while diastolic arterial blood pressure was notably higher in the propofol group (P = 0.02). In aligns to this study Sheikh et al[17], it was discovered that the dexmedetomidine group exhibited significantly lower heart rate (HR) and mean arterial pressure (MAP) compared to the propofol group (P < 0.05). Additionally, the dexmedetomidine group had significantly shorter durations of postoperative ventilation and ICU stays (P < 0.05), as well as a significantly reduced risk of delirium (P < 0.05).[17] Another study indicated that the occurrence of hypotension was notably higher in Group P compared to Group D (50% vs. 20%; P=0.015), with the systolic blood pressure in Group P being significantly lower than that in Group D at the 5th and 20th minutes following the initiation of sedation. Meanwhile, the heart rate in Group P was higher than that in Group D at the 10th minute and continuously from the 25th minute throughout the procedure duration.[18] Although the et al[19] also conducted a study to compare the hemodynamic effects and clinical outcomes of dexmedetomidine and propofol in surgical ICU patients undergoing major abdominal surgeries and they concluded that the incidences of low blood pressure, bradycardia, and severely decreased cardiac index did not

significantly differ across the both study groups. However Heybati K et al[20] observed that the Dexmedetomidine had no major impact on ICU duration of stay when contrasted with propofol, although it decreased the period of mechanical ventilation as well as the delirium risk in patients after cardiac surgery. Nevertheless, it substantially raised the likelihood of bradycardia among diverse ICU patients' subgroups. In the study by Kumar N et al[21] also reported that in contrast to propofol, dexmedetomidine resulted in significantly shorter overall length of mechanical breathing. They additionally indicated that there was, no significant differences were observed in the delirium incidence, the ICU duration and mortality. In aligns to this series, Yang LN et al[22] also reported that their randomized clinical trial is anticipated to test the hypothesis that prolonged postoperative sedation with DEX following successful reperfusion may improve the long-term prognosis of patients with AIS and potentially reduce the associated socio-economic burden.

It has been assumed that the dexmedetomidine and propofol are frequently used to improve postoperative agitation among mechanically ventilated postsurgical patients. When compared to propofol, dexmedetomidine offers several advantages for postoperative sedation. Firstly, dexmedetomidine provides a more stable and consistent level of sedation, which can be particularly beneficial for maintaining the delicate balance required in postoperative care for AIS patients. This stability in sedation levels can lead to better patient outcomes by reducing the risks associated with fluctuating sedation states. However, these results cannot be considered absolutely conclusive due to many study restrictions and the lack of substantial differences identified between the two medicines. As a result, it is advised that additional large-scale studies be done at the local level in order to verify these findings with suitable safety measures.

Conclusion

Study revealed that the dexmedetomidine and propofol both provided the effective postoperative analgesia, sedation in addition to systolic blood pressure stability at 24 hours. Moreover, dexmedetomidine may have a promising role in ICU sedation for improved outcomes in terms of shorter stays in the intensive care unit and less delirium risk.

Recommendation: Future research should concentrate on hemodynamic alterations, record all co-interventions and previous medical histories, and conduct large-scale, high-quality trials to investigate the duration of mechanical breathing, long-term death rates, and cost-efficiency.

Acknowledgement: The authors acknowledge the fellows for their valuable contributions to data collection, manuscript writing, data analysis, and literature review. They also extend their gratitude to the patients for their willingness to participate in this study

References

1. Gitti N, Renzi S, Marchesi M, Bertoni M, Lobo FA, Rasulo FA, Goffi A, et al. Seeking the light in intensive care unit sedation: the optimal sedation strategy for critically ill patients. Frontiers in Medicine. 2022 Jun 24;9:901343. https://doi.org/10.3389/fmed.2022.901343
2. Patil VP, Abraham J, George GM. Comparing dexmedetomidine and propofol for sedation and hemodynamic stability in cardio-thoracic intensive care unit for patients following off-pump coronary artery bypass graft surgery. Int J Basic Clin Pharmacol 2021;10;1-7 https://doi.org/10.18203/2319-2003.ijbcp20210085
3. Temesgen N, Chekol B, Tamirie T, Eshetie D, Simeneh N, Feleke A. Adult sedation and analgesia in a resource limited intensive care unit - a systematic review and evidence based guideline. Ann Med Surg (Lond). (2021) 66:102356. https://doi.org/10.1016/j.amsu.2021.102356
4. Prabhakar H, Tripathy S, Gupta N, Singhal V, Mahajan C, Kapoor I, et al. Consensus statement on analgo-sedation in neurocritical care and review of literature. Indian J Crit Care Med. (2021) 25:126-33 https://doi.org/10.5005/jp-journals-10071-23712
5. Hughes CG, Mailloux PT, Devlin JW, Swan JT, Sanders RD, Anzueto A, Jackson JC, Hoskins AS, Pun BT, Orun OM, Raman R. Dexmedetomidine or propofol for sedation in mechanically ventilated adults with sepsis. N Engl J Med. 2021 Apr 15;384(15):1424-36. https://doi.org/10.1056/NEJMoa2024922
6. Heidari SM, Habibzadeh M, Honarmand A, Nazemroaya B, Mousavi SA. Clinical Outcomes of Using Dexmedetomidine, ProDex and Popfol for Sedation during Mechanical Ventilation in Patients Hospitalized in the Intensive Care Unit: A Triple Blinded Clinical Trial. Anesthesiol Crit Care. 2024 Mar 5;1-6
7. Aouad MT, Zeeni C, Al Nawwar R, Siddik, Sayyid SM, Barakat HB, Elias S, et al. Dexmedetomidine for improved quality of emergence from general anesthesia: a dose finding study. Anesth Analg. 2019;129(6):1504-11 https://doi.org/10.1213/ANE.0000000000002763

8. Singh R, Batra YK, Bharti N, Panda NB. Comparison of propofol versus propofol- ketamine combination for sedation during spinal anesthesia in children: Randomized clinical trial of efficacy and safety. Paediatr Anaesth. 2010;20:439-44 https://doi.org/10.1111/j.1460-9592.2010.03286.x
9. Yamauchi M, Asano M, Watanabe M, Iwasaki S, Furuse S, 55Namiki A. Continuous low-dose ketamine improves the analgesic effects of fentanyl patient-controlled analgesia after cervical spine surgery. Anesth Analg. 2008;107:1041-4 https://doi.org/10.1213/ane.0b013e31817f1e4a
10. Patel A, Garg R, Bharti SJ, Kumar V, Gupta N, Mishra S, Bhatnagar S, Kumar A. Comparison of sedation efficacy of intravenous infusion of dexmedetomidine versus propofol in terms of opioid consumption in patients requiring postoperative mechanical ventilation after head and neck onco-surgeries-A randomized prospective study. Indian Journal of Cancer. 2024 Jan 1;61(1):81-9. https://doi.org/10.4103/ijc.IJC_949_20
11. Sattar L, Reyaz I, Rawat A, Mannam R, Karumanchi A, Depa VG, Batool S, Usama M. Comparison Between Dexmedetomidine and Propofol for Sedation on Outcomes After Cardiac Surgery in Patients Requiring Mechanical Ventilation: A Meta-Analysis of Randomized-Control Trials. Cureus. 2023 Jul 20;15(7). https://doi.org/10.7759/cureus.42212
12. Wanat M, Fitousis K, Boston F, Masud F. Comparison of dexmedetomidine versus propofol for sedation in mechanically ventilated patients after cardiovascular surgery. Methodist DeBakey Cardiovascular Journal. 2014 Apr;10(2):111. https://doi.org/10.14797/mdcj-10-2-111
13. Conti G, Ranieri VM, Costa R, Garratt C, Wighton A, Spinazzola G, Urbino R, et al. Effects of dexmedetomidine and propofol on patient-ventilator interaction in difficult-to-wean, mechanically ventilated patients: a prospective, open-label, randomised, multicentre study. Critical Care. 2016 Dec;20:1-8. https://doi.org/10.1186/s13054-016-1386-2
14. Ysenbaardt B , Nauwynck M, Mulier J. The effect of perioperative use of dexmedetomidine on time to extubation and ICU stay after coronary artery bypass graft surgery: a single-center retrospective cohort study. Acta Anaesth. Bel. 2022; 73: 135-139 https://doi.org/10.56126/73.S1.26
15. Misra S, Behera BK, Mitra JK, Sahoo AK, Jena SS, Srinivasan A. Effect of preoperative dexmedetomidine nebulization on the hemodynamic response to laryngoscopy and intubation: a randomized control trial. Korean J Anesthesiol. 2021 Apr;74(2):150. https://doi.org/10.4097/kja.20153
16. Białka S, Copik M, Karpe J, Przybyła M, Śliwczyńska M, Czyżewski D, Misiołek H. Effect of dexmedetomidine or propofol sedation on haemodynamic stability of patients after thoracic surgery. Anaesthesiology Intensive Therapy. 2018 Jan 1;50(5):356-99. https://doi.org/10.5603/AIT.a2018.0046
17. Sheikh TA, Dar BA, Akhter N, Ahmad N. A Comparative Study Evaluating Effects of Intravenous Sedation by Dexmedetomidine and Propofol on Patient Hemodynamics and Postoperative Outcomes in Cardiac Surgery. Anesth Essays Res. 2018 Apr-Jun;12(2):555-560. https://doi.org/10.4103/aer.AER_46_18
18. Techanivate A, Verawattaganon T, Saiyuenyong C, Areeruk P. A comparison of dexmedetomidine versus propofol on hypotension during colonoscopy under sedation. J Anesth Clin Res. 2012 Nov;3(11). https://doi.org/10.4172/2155-6148.1000257
19. Chang YF, Chao A, Shih PY, Hsu YC, Lee CT, Tien YW, Yeh YC, Chen LW. Comparison of dexmedetomidine versus propofol on hemodynamics in surgical critically ill patients. Journal of Surgical Research. 2018 Aug 1;228:194-200. https://doi.org/10.1016/j.jss.2018.03.040
20. Heybati K, Zhou F, Ali S, Deng J, Mohananey D, Villablanca P, Ramakrishna H. Outcomes of dexmedetomidine versus propofol sedation in critically ill adults requiring mechanical ventilation: a systematic review and meta-analysis of randomised controlled trials. Br J Anaesth. 2022 Oct 1;129(4):515-26. https://doi.org/10.1016/j.bja.2022.06.020
21. Kumar N, Kumar A, Kumar A, Hussain M, Kumar A. Comparison between dexmedetomidine and propofol for sedation during mechanically ventilated patients after major intraabdominal surgeries: An observational study. Indian J Clin Anaesth. 2018 Apr;5(2):210-5. https://doi.org/10.18231/2394-4994.2018.0039
22. Yang LN, Sun Y, Wang YZ, Wang J, Qi YS, Mu SS, Liu YP, et al. Effect of Postoperative Prolonged sedation with Dexmedetomidine after successful reperfusion with Endovascular Thrombectomy on long-term prognosis in patients with acute ischemic stroke (PPDET): study protocol for a randomized controlled trial. Trials. 2024 Dec;25(1):1-2. https://doi.org/10.1186/s13063-024-08015-x