

Comparison of Outcomes of Dexmedetomidine vs Midazolam for Sedation in Mechanically Ventilated Neurosurgical patients at Surgical ICU, Karachi

SADAF ZEHRA¹, SAMRAH SHAFQAT², SHAHNEELA RAZA³, ALINA SIDDIQUI⁴, SOBIA QAMER⁵, SHOAB AKHTAR⁶

¹Registrar, Department of Anesthesia, Tabba Kidney Institute, Postgraduate Training & Research Centre, Karachi

²Consultant Anesthesiologist, Department of Anesthesia, Critical Care & Pain Medicine, Dow University of Health Sciences, Karachi

³Assistant Professor, ⁶Head of Department of Anesthesia, Critical Care & Pain Medicine, Jinnah Postgraduate Medical Centre, Karachi

⁴Clinical Fellow, Department of Anesthesia, National Institute of Cardiology & Vascular Disease, Karachi

⁵Postgraduate Resident, Jinnah Postgraduate Medical Centre, Karachi

Correspondence to Dr. Sadaf Zehra, E-mail: xehra.sohail@hotmail.com, Cell: 0332-2428012,

ABSTRACT

Aim: To compare the outcomes of dexmedetomidine versus midazolam for sedation in mechanically ventilated neurosurgical patients at Tertiary Care Hospital, Karachi.

Study design: Randomized control trial.

Place and duration of study: Department of Anesthesia, JPMC, Karachi from 20th November 2020 to 20th May 2021.

Methodology: One hundred patients who met the diagnostic criteria were enrolled. Brief history was taken and demographic information was noted.

Results: Mean ages and duration of mechanical ventilations in dexmedetomidine group was 49.78±10.54 years and 93.54±10.53 hours while in midazolam group was 50.41±12.39 years and 117.50±15.51 hours. Mean extubation time in the dexmedetomidine and midazolam group was 35.27±0.57 minutes and 48.84±0.53 minutes and statistically the difference was significant (P=0.01). Whereas, mean Ramsay sedation score in the dexmedetomidine and midazolam group was 3.03±0.04 and 3.92±0.06. P-value was 0.01.

Conclusion: Dexmedetomidine prove to be drug of good choice for sedation during neurosurgical mechanism as compared to midazolam. It also showed good extubation time and hemodynamic stability.

Keywords: Dexmedetomidine, Midazolam, Sedation, Mechanically ventilated, Hemodynamic changes, Neuro-protection

INTRODUCTION

Intensive care units cater only those patients that are suffering from terminal or life threatening injuries and trauma which require constant support and monitoring from health care personnel's through special equipment and medications. Appropriate pain management, hemodynamic stability and vitals are constantly kept in controlled and monitored in ICU especially for ventilated patients¹⁻³. Poor pain management often lead to longer hospital stays and prolonged the duration of mechanical ventilation¹.

Sedation is a common practice to reduce anxiety, increase tolerance, and improve outcomes of such interventions⁴⁻⁵. For decades, sedative agents are gamma-aminobutyric receptor agonists (GABA) including propofol and benzodiazepines such as midazolam. They have been the most commonly administered sedative drugs for ICU patient worldwide⁷⁻¹⁰. An ideal sedative agent must have the properties of rapid modification by adjusting different titration doses and must have no effect on respiratory or cardiovascular system¹¹.

Optimum sedation is the most important factor for health care personnel's during surgical procedure which not only reduce the chances of pain but also enhance the recovery and shorter hospital stay. Over sedation also cause detrimental results which leads to mortality and morbidity in patients^{4,12,13}. Various sedative and analgesic drugs are now being used which have distinct therapeutic properties¹⁴. Dexmedetomidine have α_2 -adrenoceptors which have the properties of inducing sedation, analgesia and anxiolysis with causing respiratory distress¹⁵. Midazolam is also an ideal supplemental sedative with fast onset and short recovery time¹⁶. In a study, mean heart rate at 1 hour (76.67±6.64 vs 84.20±5.23), 3 hour (68.89±4.58 vs 81.20±5.52) and 6 hour (66.71±3.11 vs 82.45±6.28) after infusion of dexmedetomidine versus midazolam. Mean arterial pressure at 1 hour (95.93±6.21 vs 98.27±6.68), 3 hour (92.89±7.35 vs 95.07±5.03) and 6 hour (95.86±5.72 vs 94.51±6.32) after infusion of dexmedetomidine versus midazolam. Mean Ramsay sedation score (RSS) was found as 3.42±0.74 in dexmedetomidine and 3.62±0.94 in midazolam group. Mean extubation time was found as 35.28±5.92 min in dexmedetomidine and 48.21±7.23 min in midazolam group¹⁷.

MATERIALS AND METHODS

This randomized control trial was conducted at Karachi in Jinnah Postgraduate Medical Center from the duration of 20th November 2020 to 20th May 2021 and 100 patients were enrolled. They were divided in two groups; each group comprised 50 patients. Mechanically ventilated neurosurgical patients, either gender and age 30-60 years were included. Patients who had the history of opioids, benzodiazepine and allergic to any drug, history of hypertension, history of myocardial infarction, history of taking β blockers, α blockers, or calcium channel blockers, pregnant patients assessed by history and confirmed by dating scan and history of stroke, asthma, renal impairment, hypothyroidism, chronic liver disease and CCF were excluded from the study. Patients who are expected to have the need of post-operative ventilator support and undergoing neurosurgical procedure were included. A standard anesthetic technique for the perioperative period was performed. Maintenance of anesthesia was done with oxygen and isoflurane. When surgical procedure was done, patient was shifted to ICU for elective ventilation. In ICU, patients were randomly divided into two groups; group D and group M to receive infusions of dexmedetomidine or midazolam. Infusion rate was adjusted by ICU doctor according to the patient's requirement. Midazolam dose was 0.04mg/kg over 15 minutes through maintenance infusion at 0.08mg/kg/h rate while dexmedetomidine loading dose was 1mcg/kg for 15 minutes followed by 0.4-0.7 mcg/kg/h maintenance infusion. During the mechanical ventilation the researcher made a note of (heart rate and mean arterial pressure at 1 hour after infusion, 3 hour after infusion, 6 hour after infusion), Ramsay sedation score at 1 hour after infusion and extubation time at the end of mechanical ventilation as per operational definition. The findings of quantitative variable (age, heart rate, mean arterial pressure, RSS score) was noted in both groups and duration of mechanical ventilation) and qualitative variables (gender, residence status, diabetes mellitus type II, family monthly income, occupational status and smoking status) were noted. Data was entered and analyzed using SPSS-20. Independent t-test was used to compare outcome of both groups.

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RESULTS

The minimum age of the patient was 35 while maximum was 60 years. The mean age and duration of mechanical ventilation in our study was 49.78 ± 10.54 years and 93.54 ± 10.53 hours in dexmedetomidine group while in midazolam group, 50.41 ± 12.39 years and 117.50 ± 15.51 hours (Table 1).

There were 27(54%) and 23(46%) were in age group 30-45 years and 46-60 years in dexmedetomidine group, whereas in midazolam group, 23(46%) and 27(54%) were in age group 30-45 years and 46-60 years respectively. In dexmedetomidine group, 28(56%) and 22(44%) were male and female while in midazolam group, 28 (56%) and 22(44%) were male and female respectively. There were 26 (52%) and 24(48%) had urban and rural residence in dexmedetomidine group and in midazolam group, 32(64%) and 18(36%) had urban and rural residence respectively. According to occupation, 24(48%) were employed and 26(52%) were unemployed in dexmedetomidine group while in midazolam group, 30(60%) were employed and 20(40%) were unemployed. In the dexmedetomidine group, 24(48%) have diabetes mellitus type II and 26(52%) have no diabetes mellitus type II whereas in the midazolam group, 20(40%) have diabetes mellitus type II and 30(60%) have no diabetes mellitus type II. According to smoking, 18(36%) were smokers and 32(64%) not smokers in dexmedetomidine group while in midazolam group, 11(22%) were smokers and 39(78%) were not smokers (Table 2).

Table 1: Descriptive statistics of both groups (n=100)

Variable	Dexmedetomidine Group	Midazolam Group
Age (years)	49.78 ± 10.54	50.41 ± 12.39
Duration of mechanical ventilation (hours)	93.54 ± 10.53	117.50 ± 15.51

Table 2: Demographic information of the patients in both groups (n=100)

Variable	Dexmedetomidine Group (n=50)	Midazolam Group (n=50)
Age (years)		
30 – 45	27 (54%)	23 (46%)
46 – 60	23 (46%)	27 (54%)
Gender		
Male	28 (56%)	28 (56%)
Female	22 (44%)	22 (44%)
Residence status		
Urban	26 (52%)	32 (64%)
Rural	24 (48%)	18 (36%)
Occupation		
Employed	24 (48%)	30 (60%)
Unemployed	26 (52%)	20 (40%)
Diabetes mellitus type II		
Yes	24 (48%)	20 (40%)
No	26 (52%)	30 (60%)
Smoking status		
Yes	18 (36%)	11 (22%)
No	32 (64%)	39 (78%)

Mean heart rate at 1st hour in the dexmedetomidine and midazolam group was 75.78 ± 2.92 beats/minutes and 84.35 ± 2.85 beats/minutes ($P < 0.05$). At 3 hours, mean heart rate in midazolam and dexmedetomidine group was 81.47 ± 2.04 beats/min and 67.25 ± 2.34 beats/min ($P < 0.05$). At 6 hours, mean heart rate in the dexmedetomidine and midazolam group was 66.31 ± 1.70 beats/minutes and 82.96 ± 2.78 beats/minutes with P value of < 0.05 . Mean arterial pressure at 1st hour in the dexmedetomidine and midazolam group was 95.74 ± 3.12 mmHg and 97.39 ± 2.96 mmHg with P value was 0.01. At 3 hours, mean arterial pressure in the dexmedetomidine and midazolam group was 95.01 ± 2.52 mmHg and 94.09 ± 3.17 mmHg with P value was 0.01. At 6 hours, mean arterial pressure in the dexmedetomidine and midazolam group was 94.60 ± 3.24 mmHg and 94.21 ± 3.72 mmHg with P value was 0.01. Mean extubation time in the dexmedetomidine and midazolam group was 35.27 ± 0.57 minutes and 48.84 ± 0.53 minutes with P value was 0.01. Mean Ramsay sedation score in

the dexmedetomidine and midazolam group was 3.03 ± 0.04 and 3.92 ± 0.06 with P value was 0.01 (Table 3).

Table 3: Comparison of heart rate, mean arterial pressure, extubation time, Ramsay sedation score in both groups (n=100)

Variable	Dexmedetomidine Group	Midazolam group	P value
Heart Rate			
At 1 hour	75.78 ± 2.92	84.35 ± 2.85	0.001
At 3 hours	67.25 ± 2.34	81.47 ± 2.04	0.001
At 6 hours	66.31 ± 1.70	82.96 ± 2.78	0.001
Mean Arterial Pressure			
At 1 hour	95.74 ± 3.12	97.39 ± 2.96	0.001
At 3 hours	95.01 ± 2.52	94.09 ± 3.17	0.001
At 6 hours	94.60 ± 3.24	94.21 ± 3.72	0.001
Extubation time	35.27 ± 0.57	48.84 ± 0.53	0.01
Ramsay sedation score	3.03 ± 0.04	3.92 ± 0.06	0.01

DISCUSSION

Providing sedation for patient comfort is an integral component of bedside care for nearly every patient in the ICU.¹⁸ Inadequate sedation can lead to detrimental effects and become the cause of mortality in ICU patients. Along with sedation, it also cause some positive effects during surgery including modulation of neuroendocrine stress and by lowering chances of inflammatory response that can prove significant in fast recovery. Long term and over dosage of these drugs are also problematic and lead to influence the whole body mechanism of the patient.¹⁹⁻²¹ Various potent drugs are used for sedation in neurosurgical procedures such as propofol, dexmedetomidine and midazolam which have extra advantageous over other drugs by lowering the requirement of fentanyl requirement.

The interaction of opioids and α_2 adrenoreceptors reduce the need of fentanyl requirement. This receptor has equally beneficial effect on spinal cord by modulating descending noradrenergic pathways which ultimately reduce the overall need of opioids.^{22,23} In present study, the mean age and duration of mechanical ventilation in our study was 49.78 ± 10.54 years and 93.54 ± 10.53 hours in dexmedetomidine group while in midazolam group, 50.41 ± 12.39 years and 117.50 ± 15.51 hours. Studies reported that HR get lowered in dexmedetomidine patients but no positive correlation was found with midazolam group.²⁴ Significant difference was not observed in drug administration group as compared to the control participants.

The lower heart rate was observed in dexmedetomidine group because of the involvement of sympatholytic effect of the drug but this effect was quite minimal and for short duration of time. Propofol inhibits the baroreflex thus lowering tachycardic effect in response to hypotension. Therefore, dexmedetomidine can be a better choice of drug for various surgical procedures with minimal adverse effects²⁵⁻²⁷.

CONCLUSION

Dexmedetomidine prove to be drug of good choice for sedation during neurosurgical mechanism as compared to midazolam. It also showed good extubation time and hemodynamic stability. Dexmedetomidine also also lowers the requirement of post-operative analgesic.

Conflict of interest: Nil

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