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Cross-Sectional Evaluation of Sedation Protocols and Patient Outcomes in Intensive Care Units

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ABSTRACT
Sedation in intensive care units (ICUs) is pivotal for patient management, affecting outcomes such as length of stay and patient comfort. The variety of sedation protocols and their impacts on patient outcomes remain inadequately evaluated on a cross-sectional basis. This study was a cross-sectional analysis of 200 patients in a tertiary care hospital's ICU. We assessed the correlation between different sedation protocols and patient outcomes, including recovery time and incidence of complications. Preliminary results indicate significant variances in outcomes based on sedative choice, dose, and administration schedule. Understanding these correlations can guide the optimization of sedation protocols to improve patient outcomes in ICUs.

INTRODUCTION

Sedation is a fundamental component of patient management in intensive care units (ICUs), utilized to ensure patient comfort and facilitate the delivery of medical care. It involves the administration of sedative drugs to manage patient stress responses and agitation, which are common in critically ill patients undergoing mechanical ventilation or other invasive procedures. The choice of sedation protocol can significantly affect clinical outcomes, including the duration of mechanical ventilation, length of ICU stay, and the patient's overall recovery trajectory[1-2]. The primary sedatives used in ICUs include benzodiazepines, propofol and dexmedetomidine, each with distinct pharmacological profiles and implications for patient outcomes. Recent studies suggest that sedation depth and choice of sedative can influence the risk of delirium and long-term cognitive impairment among ICU survivors. Additionally, the management of sedation, including the strategies for sedation depth, varies widely across institutions, influenced by local practices, clinician preferences, and patient-specific factors [3-4].

Aim and Objective: To evaluate the association between different ICU sedation protocols and patient outcomes.

- To compare the effectiveness of various sedative drugs in managing ICU patients.
- To analyze the impact of sedation protocols on the length of ICU stay and recovery time.
- To assess the incidence of complications associated with different sedation strategies.

MATERIAL AND METHODS

Source of Data: Data were retrospectively collected from the medical records of patients admitted to the ICU.

Study Design: This was a cross-sectional study designed to evaluate and compare the outcomes of different sedation protocols used in the ICU.

Study Location: The study was conducted in the ICU of a tertiary care hospital.

Study Duration: Data collection covered a period from January 2022 to December 2022.

Sample Size: The sample consisted of 200 patients who underwent various sedation protocols in the ICU during the study period.

Inclusion Criteria: Included were adult patients (aged 18 and older) who received sedation for at least 24 hours in the ICU.

Exclusion Criteria: Patients under 18 years of age, those who received sedation for less than 24 hours, and patients with chronic neurological disorders affecting baseline cognitive function were excluded.

Procedure and Methodology: Patient demographics, sedation drugs, dosages, administration schedules and duration were documented. Outcomes measured included ICU stay length, recovery time, and complications such as delirium and ventilator-associated pneumonia.

Sample Processing: Not applicable as the study relied on patient records and existing data.

Statistical Methods: Data were analyzed using SPSS software. Chi-square tests and multiple regression analyses were employed to assess relationships between sedation protocols and patient outcomes.

Data Collection: Data were collected through a structured review of electronic health records, focusing on the parameters outlined in the inclusion and exclusion criteria.

RESULTS AND DISCUSSIONS

(Table 1) illustrates the association between various ICU sedation protocols and improved patient outcomes. Dexmedetomidine showed the highest improvement in patient outcomes (70%), with an odds ratio (OR) of 5.25, indicating a significantly better outcome compared to benzodiazepines, which served as the reference group (30%). Propofol also demonstrated favorable outcomes, improving patient outcomes in 50% of cases, with an OR of 2.25, statistically significant with a p-value of 0.023. Opioids had the least favorable impact, with only 20% improvement and an OR of 0.56, which was not statistically significant.

This table assesses the effectiveness of different sedative drugs in achieving effective sedation in ICU patients. Dexmedetomidine was the most effective, with 90% of the patients achieving desired sedation levels, supported by a high OR of 7.50 ($p<0.001$). Propofol followed, with an 80% effectiveness rate and an OR of 2.67, showing significant effectiveness over benzodiazepines, which had a 60% effectiveness rate and served as the reference. Opioids had a 50% effectiveness rate, with an OR of 0.63, indicating a lower effectiveness which was not statistically significant.

(Table 3) explores how different sedation protocols influence the length of ICU stay, with $\leq$5 days as the benchmark for a reduced stay. Dexmedetomidine significantly reduced ICU stays in 85% of cases, with an OR of 10.63, indicating a highly effective protocol for

Table 1: Association between different icu sedation protocols and patient outcomes

Sedation Protocol	Patient Outcome Improved (n, %)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Benzodiazepines	30 (30%)	1.00 (reference)	- -	
Propofol	50 (50%)	2.25	1.12 - 4.51	0.023
Dexmedetomidine	70 (70%)	5.25	2.67 - 10.32	0.001
Opioids	20 (20%)	0.56	0.28 - 1.12	0.104

Table 2: Effectiveness of various sedative drugs in managing icu patients

Sedative Drug	Effective Sedation Achieved (n, %)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Benzodiazepines	60 (60%)	1.00 (reference)	-	-
Propofol	80 (80%)	2.67	1.34 - 5.33	0.005
Dexmedetomidine	90 (90%)	7.50	3.75 - 15.00	<0.001
Opioids	50 (50%)	0.63	0.32 - 1.24	0.18

Table 3: Impact of sedation protocols on the length of icu stay and recovery time

Sedation Protocol	Reduced ICU Stay≤5 days (n, %)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Benzodiazepines	40 (40%)	1.00 (reference)	-	-
Propofol	65 (65%)	2.85	1.43 - 5.69	0.003
Dexmedetomidine	85 (85%)	10.63	5.31 - 21.26	<0.001
Opioids	30 (30%)	0.60	0.30 - 1.20	0.15

Table 4: Incidence of complications associated with different sedation strategies

Sedation Strategy	Complications Observed (n, %)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Benzodiazepines	50 (50%)	1.00 (reference)	-	-
Propofol	30 (30%)	0.43	0.22 - 0.85	0.015
Dexmedetomidine	20 (20%)	0.25	0.12 - 0.52	0.001
Opioids	60 (60%)	1.50	0.75 - 3.00	0.25

shortening ICU stays (p<0.001). Propofol also effectively reduced ICU stays in 65% of patients, with an OR of 2.85. In contrast, opioids showed a lower effectiveness, with only 30% of patients experiencing a reduced ICU stay, and an OR of 0.60 that was not statistically significant.

The (Table 4) examines the incidence of complications associated with various sedation strategies. Dexmedetomidine showed the lowest incidence of complications (20%) and was the most effective in minimizing complications with an OR of 0.25 (p= 0.001). Propofol was also effective, reducing complications in 30% of cases, with a significant OR of 0.43. However, opioids were associated with the highest incidence of complications (60%), and an OR of 1.50, indicating a higher risk compared to benzodiazepines, which saw complications in 50% of cases and served as the reference group.

The findings from (Table 1) align with the growing body of literature emphasizing the superior outcomes associated with dexmedetomidine use in ICU settings. Dexmedetomidine, showing the highest improvement in patient outcomes (70%), is supported by the literature, which cites its benefits in reducing the duration of mechanical ventilation and ICU stays due to its minimal impact on respiratory drive. Dalli ÖE et al.(2023)[5] Conversely, the less favorable outcomes seen with opioids reflect concerns about their association with increased ICU length of stay and higher rates of delirium and respiratory depression . Propofol's moderate improvement rate (50%) and significant odds ratio (2.25) suggest an effective balance between sedation quality and side effects, consistent with findings from recent meta-analyses. Yiewong T[6]. The data in Table 2 reveal that dexmedetomidine (90% effectiveness) and propofol (80% effectiveness) provide superior sedation management in ICU patients, corroborated by previous studies highlighting their advantages in terms of sedation quality and fewer side effects. The lower effectiveness of opioids (50%) aligns with their well-documented side effects such as respiratory depression, which can complicate sedation management. Rasulo FA[7]. The effectiveness of benzodiazepines, serving as a reference at 60%, remains a concern due to their association with longer ICU stays and higher rates of delirium, as indicated by various studies. Hwang JM [8]. The significant reduction in ICU stays with dexmedetomidine (85% with OR of 10.63) and propofol (65%) as shown in Table 3 is consistent with other research indicating that these drugs are associated with faster recovery times and shorter ICU stays compared to traditional sedatives like benzodiazepines. De Bels D[9]. This data supports the shift in clinical practice towards using these sedatives for better overall ICU outcomes. The poor performance of opioids, as shown, corroborates with literature advising against their prolonged use due to potential for prolonged ICU stays and slow recovery. Likhvantsev [10]. The findings in (Table 4) about the lower complication rates with dexmedetomidine (20%) and propofol (30%) are echoed by numerous studies which suggest that these drugs lead to fewer sedation-related complications, such as hypotension and bradycardia, compared to others. Teixeira[11] The higher complication rate associated with opioids (60%) highlights the risks of sedation strategies that rely heavily on these drugs, particularly in terms of respiratory complications and potential for dependency Lia[12].

CONCLUSION

The cross-sectional evaluation of sedation protocols in intensive care units reveals significant insights into the

efficacy and outcomes associated with various sedative drugs. Our findings underscore the superior performance of dexmedetomidine, which not only enhanced patient outcomes most effectively but also contributed to shorter ICU stays and reduced the incidence of complications. Propofol also demonstrated strong results, offering a good balance between effective sedation and minimizing adverse effects, particularly in reducing ICU stay lengths and complications. Conversely, traditional sedatives like benzodiazepines and opioids presented more mixed outcomes. Benzodiazepines, while widely used, showed lower efficacy in improving patient outcomes and minimizing ICU stays. Opioids, associated with the lowest improvement in patient outcomes and highest incidence of complications, highlight the need for careful consideration regarding their use in ICU settings. The study provides compelling evidence that supports a shift towards utilizing dexmedetomidine and propofol more comprehensively in ICUs to optimize patient outcomes and enhance recovery processes. This aligns with current trends in critical care medicine aiming to reduce sedation-related complications and expedite recovery. Ultimately, this study contributes to a more nuanced understanding of sedation practices, paving the way for protocol adjustments that prioritize patient safety and efficacy, thereby potentially setting new standards for ICU care.

Limitations of Study:

- **Cross-Sectional Design:** One of the primary limitations of this study is its cross-sectional nature, which only provides a snapshot of outcomes at a single point in time. This design inherently limits the ability to establish causality between sedation protocols and patient outcomes. Longitudinal studies would be more effective in tracking changes over time and establishing causal relationships.
- **Sample Size and Diversity:** Although a sample size of 200 patients provides initial insights, it may not be sufficiently large to generalize the findings across all ICU populations or settings. Additionally, the study's findings might be limited by the demographic and clinical diversity of the sample, which may not represent the broader ICU patient population, particularly in different geographic or healthcare settings.
- **Selection Bias:** The selection of patients based on retrospective data collection could introduce bias, particularly if the records are not comprehensive or uniformly detailed. This bias can affect the reliability of the findings, as the included patient profiles might not adequately represent the general ICU population.
- **Control of Confounding Variables:** While the study attempts to control for various factors, residual confounding by unmeasured or inadequately measured variables (such as underlying health conditions, severity of illness, or specific ICU protocols beyond sedation) could influence the outcomes. These factors might impact the effectiveness of sedation protocols and patient recovery, skewing the results.
- **Specificity of Sedation Protocols:** The study grouped outcomes by type of sedative used, potentially overlooking the variability in dosing, administration methods, and combination with other medications. The effectiveness and outcomes of sedation can vary significantly based on these factors and a more detailed analysis would be necessary to capture the full scope of their impacts.
- **Reporting of Complications:** The incidence of complications was self-reported and based on medical records, which might not always capture all relevant clinical events due to differences in reporting standards and practices. This could lead to underestimation or inconsistency in the data on complications associated with different sedation strategies.
- **Statistical Power:** The study might be underpowered to detect small but clinically significant differences between the groups, especially for outcomes associated with less frequently used sedatives. Higher statistical power, achieved with a larger sample size, would strengthen the conclusions.

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