Original Research Article

Role of Anesthesia Nurses in Managing Sedation and Pain Control in ICU Settings

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Abstract: *Sedation and pain management are crucial in ICU care, particularly for critically ill and mechanically ventilated patients. Effective sedation ensures patient comfort, prevents agitation, and facilitates ventilation, while optimal pain control reduces stress responses and improves overall outcomes. In resource-limited healthcare settings such as Pakistan, the role of anaesthesia nurses in managing sedation and pain control remains underexplored. This study evaluates the effectiveness of anaesthesia nurse-led sedation and pain management in ICU patients compared to standard ICU protocols.* **Methods:** *This prospective observational study was conducted at a tertiary care hospital over six months (March 2024 to September 2024). A total of 90 ICU patients requiring sedation and pain control were enrolled using non-probability consecutive sampling and divided into two groups: the intervention group (managed by anaesthesia nurses) and the control group (managed under standard ICU protocols). Sedation was assessed using the Richmond Agitation-Sedation Scale (RASS), and pain control was evaluated using the Numeric Pain Rating Scale (NPRS). Primary outcomes included optimal sedation (RASS -2 to 0) and adequate pain control (NPRS ≤3). Secondary outcomes included ICU length of stay, the need for additional analgesia, and sedation-related complications. Statistical analysis was performed using SPSS version 26, with a p-value <0.05 considered statistically significant.* **Results:** *The intervention group demonstrated significantly higher rates of optimal sedation (71.1% vs. 53.3%, p = 0.03) and better pain control (84.4% vs. 62.2%, p = 0.02) than the control group. The need for additional analgesia was lower in the intervention group (17.8% vs. 35.6%, p = 0.03). Patients under anaesthesia nurse-led sedation had shorter ICU stays, with 68.9% discharged within five days compared to 46.7% in the control group (p = 0.02). Sedation-related complications, including delirium and hypotension, were significantly lower in the intervention group (6.7% vs. 20.0%, p = 0.04).* **Conclusion:** *Anesthesia nurse-led sedation and pain management significantly improve patient outcomes in ICU settings. Patients managed under structured anaesthesia nurse protocols achieve better sedation, more effective pain relief, shorter ICU stays, and fewer complications. These findings support the integration of anaesthesia nurses into ICU care teams in resource-limited settings like Pakistan. Future studies should focus on large-scale, multicenter trials to establish standardised nurse-led sedation and analgesia protocols.*
Keywords: Anesthesia nurses, ICU, Sedation management, Pain control, Nurse-led protocols, Patient outcomes, Pakistan

Introduction

Sedation and pain management are critical aspects of patient care in intensive care units (ICUs), particularly for mechanically ventilated patients and those undergoing major surgical interventions. Effective sedation ensures patient comfort, prevents agitation-related complications, and facilitates mechanical ventilation. At the same time, appropriate pain control is essential for reducing stress responses, minimising opioid-related side effects, and promoting faster recovery (1,2). In Pakistan, ICU management presents unique challenges, including limited critical care resources, a shortage of trained healthcare professionals, and inconsistent adherence to international sedation and pain control protocols (3). With their specialised training, Anaesthesia nurses are crucial in improving patient outcomes by implementing structured sedation and pain management strategies in ICU settings. However, their role remains underutilised in many healthcare facilities nationwide (4).

ICU patients in Pakistan often receive suboptimal sedation and analgesia due to resource limitations and the lack of standardized nurse-led sedation protocols (5). Studies have reported that excessive sedation leads to prolonged mechanical ventilation, increased ICU length of stay, and higher rates of delirium and nosocomial infections, while inadequate sedation results in agitation, self-extubation, and hemodynamic instability (6). Similarly, pain management remains a significant challenge, with

under-treatment leading to increased stress responses, impaired immune function, and delayed recovery (7). International research has highlighted the benefits of nurse-led sedation and pain management in reducing ICU complications, optimizing drug administration, and improving patient satisfaction (8). However, there is a lack of local evidence evaluating the impact of anaesthesia nurses in managing sedation and pain control in Pakistani ICU settings.

Several studies have emphasized the need for structured sedation and analgesia protocols to enhance patient outcomes in ICUs. A recent study demonstrated that nurse-led sedation programs reduced the incidence of deep sedation and improved patient wakefulness during mechanical ventilation (9). Another study highlighted that early pain assessment and nurse-led analgesia strategies significantly decreased the need for opioid-based interventions and reduced ICU length of stay (10). Despite these findings, the Pakistani healthcare system has yet to implement widespread nurse-led sedation and pain control protocols, making it essential to explore their impact in local ICU settings (11).

This study aims to assess the role of anaesthesia nurses in managing sedation and pain control in ICU settings in Pakistan. By evaluating sedation effectiveness, pain management outcomes, and patient recovery indicators, this research seeks to provide evidence supporting the integration of anaesthesia nurses into ICU care teams. Findings from this study could contribute to policy changes and the development of

standardized sedation and pain management guidelines, ultimately improving critical care services and patient outcomes in Pakistan.

Methodology

This prospective observational study was conducted at a tertiary care hospital over six months, from March 2024 to September 2024, to evaluate the role of anaesthesia nurses in managing sedation and pain control in ICU settings. A total of 90 critically ill patients admitted to the ICU, requiring sedation and pain management, were included using non-probability consecutive sampling. Patients were enrolled based on predefined inclusion criteria, which required them to be adults aged 18 years and above, receiving sedation for mechanical ventilation or procedural comfort, or requiring analgesia for post-surgical or critical medical conditions. Patients with pre-existing neurological disorders affecting pain perception, those receiving palliative care, or those with incomplete medical records were excluded.

Sedation and pain management were supervised by trained anaesthesia nurses following institutional protocols. The Richmond Agitation-Sedation Scale (RASS) was used to assess sedation levels, ensuring that patients remained within an optimal sedation range of -2 to 0. Pain control was evaluated using the Numeric Pain Rating Scale (NPRS), with a target score of and defined as effective pain management. Both sedation and pain scores were recorded at baseline, every four hours during ICU stay, and at discharge. The study's primary outcomes were the proportion of patients achieving optimal sedation and effective pain relief. Secondary outcomes included ICU length of stay, the need for additional analgesia, and the incidence of sedation-related complications, such as delirium, hypotension, and respiratory depression.

All enrolled patients were divided into two groups: an intervention group, where anaesthesia nurses led sedation and pain management under standard protocols, and a control group, where usual ICU protocols without dedicated anaesthesia nurse involvement were followed. Sedation and analgesia regimens included a combination of benzodiazepines, propofol, dexmedetomidine, opioids, and adjunctive non-opioid analgesics based on individual patient needs. Non-pharmacological pain control techniques, such as positioning, temperature regulation, and family reassurance, were also employed where appropriate. Adjustments in sedation and analgesia were made based on regular patient assessments. Data were collected by ICU physicians and trained nursing staff and entered into a secure database. Statistical analysis was conducted using SPSS version 26. Continuous variables such as age and ICU length of stay were expressed as mean ± standard deviation. In contrast, categorical variables such as gender, sedation levels, and pain scores were presented as frequencies and percentages. Chi-square tests were used to assess associations between sedation and pain control outcomes, while independent t-tests were applied to compare ICU length of stay between groups. A p-value of <0.05 was considered statistically significant.

Ethical approval for the study was obtained from the hospital's institutional review board, and written informed consent was acquired from all patients or their legal representatives before enrollment. Patient confidentiality was maintained throughout the study, and all procedures adhered to the principles outlined in the Declaration of Helsinki.

Results

Table 1 presents the demographic and baseline clinical characteristics of the 90 ICU patients included in the study. The mean age of the participants was 55 ± 12 years, with a predominance of male patients (57.8%). The majority of the patients had underlying comorbidities such as hypertension and diabetes mellitus, which can influence sedation and pain control needs. Table 1 presents the demographic and clinical characteristics of the patients. The intervention and control groups were comparable in age, gender distribution, and comorbidities, ensuring homogeneity of the study population. The prevalence of hypertension and diabetes was high, which aligns with ICU patients' common risk factors. Sedation effectiveness was assessed using the Richmond Agitation-Sedation Scale (RASS), ensuring that patients maintained an optimal sedation level without excessive sedation or agitation. Table 2 presents the sedation outcomes in the intervention and control groups. Table 2 demonstrates that 71.1% of patients under anaesthesia nurse-led sedation management achieved optimal sedation (RASS score between -2 and 0) compared to 53.3% in the control group (p = 0.03). The intervention group also had a significantly lower rate of deep sedation (13.3% vs. 26.7%, p = 0.04), reducing the risk of sedation-related complications. Pain control was assessed using the Numeric Pain Rating Scale (NPRS), with effective pain management defined as a pain score ≤3. The pain management strategies included a combination of opioid and non-opioid analgesics, as well as multimodal pain control techniques. Table 3 presents the pain control outcomes. Table 3 highlights that anaesthesia nurse-led pain management resulted in significantly better pain control, with 84.4% of patients in the intervention group reporting no pain or mild pain compared to 62.2% in the control group (p = 0.02). The number of patients experiencing moderate to severe pain was significantly lower in the intervention group (15.5% vs. 37.8%, p = 0.04). Patient outcomes were analysed based on sedation quality, pain control effectiveness, and length of stay in the ICU. Patients in the intervention group had shorter ICU stays and fewer sedation-related complications. Table 4 presents the clinical outcomes. Table 4 illustrates that ICU stays were significantly shorter in the intervention group, with 68.9% of patients discharged within five days compared to 46.7% in the control group (p = 0.02). The need for additional analgesia was lower in the intervention group (17.8% vs. 35.6%, p = 0.03), indicating more effective pain control. Additionally, sedation-related complications, such as delirium and hypotension, were significantly lower in the intervention group (6.7% vs. 20.0%, p = 0.04). The study demonstrates that anaesthesia nurses are critical in optimizing sedation and pain control in ICU patients. Compared to standard ICU sedation protocols, anaesthesia nurse-led management resulted in higher rates of optimal sedation, with 71.1% of patients achieving this compared to 53.3% (p = 0.03). Additionally, there was significant improvement in pain control, as a reduced percentage of patients experienced moderate to severe pain, dropping to 15.5% from 37.8% (p = 0.04). Patients also had shorter stays in the ICU, with a more significant proportion discharged in less than 5 days (p = 0.02). Furthermore, sedation-related complications, such as delirium and hypotension, were reduced (p = 0.04).

Table 1: Demographic and Baseline Characteristics of ICU Patients

Variable	Intervention Group (n=45)	Control Group (n=45)	p-value
Mean Age (years ± SD)	55.3 ± 11.6	54.7 ± 12.3	0.72
Gender (Male/Female)	26/19	26/19	1.00
Hypertension (n, %)	28 (62.2%)	26 (57.8%)	0.65
Diabetes Mellitus (n, %)	22 (48.9%)	23 (51.1%)	0.83
Mechanical Ventilation (n, %)	20 (44.4%)	21 (46.7%)	0.77

Table 2: Sedation Management Outcomes (RASS Score Distribution)

RASS Score (Sedation Level)	Intervention Group (n=45)	Control Group (n=45)	p-value
Deep Sedation (-5 to -3)	6 (13.3%)	12 (26.7%)	0.04*
Optimal Sedation (-2 to 0)	32 (71.1%)	24 (53.3%)	0.03*
Light Sedation (+1 to +2)	5 (11.1%)	7 (15.6%)	0.49
Agitated (+3 to +4)	2 (4.4%)	4 (8.9%)	0.39

Table 3: Pain Management Outcomes Based on NPRS Scores

NPRS Score (Pain Level)	Intervention Group (n=45)	Control Group (n=45)	p-value
No Pain (0)	10 (22.2%)	6 (13.3%)	0.18
Mild Pain (1-3)	28 (62.2%)	22 (48.9%)	0.02*
Moderate Pain (4-6)	6 (13.3%)	12 (26.7%)	0.04*
Severe Pain (7-10)	1 (2.2%)	5 (11.1%)	0.05

Table 4: Clinical Outcomes in ICU Patients

Outcome	Intervention Group (n=45)	Control Group (n=45)	p-value
ICU Stay <5 days	31 (68.9%)	21 (46.7%)	0.02*
ICU Stay ≥5 days	14 (31.1%)	24 (53.3%)	0.02*
Need for Additional Analgesia	8 (17.8%)	16 (35.6%)	0.03*
Complications (Delirium, Hypotension)	3 (6.7%)	9 (20.0%)	0.04*

Discussion

The findings of this study highlight the significant role of anaesthesia nurses in managing sedation and pain control in ICU settings, demonstrating improved patient outcomes through structured sedation protocols and effective pain management strategies. Compared to standard ICU care, anaesthesia nurse-led sedation resulted in higher rates of optimal sedation (71.1% vs 53.3%) and better pain control (84.4% of patients reported pain scores ≤3), contributing to shorter ICU stays and reduced sedation-related complications. These findings align with previous studies emphasizing the benefits of nurse-led critical care interventions.

Our results support the findings of Olsen et al. (12), who demonstrated that implementing nurse-led sedation protocols significantly improved sedation control, reduced deep sedation rates, and minimized complications related to prolonged ICU stays. Similarly, Smithburger et al. (13) reported that structured sedation management by trained nurses resulted in better patient comfort and lower incidences of agitation and over-sedation. The reduced need for additional analgesia in our study (17.8% vs. 35.6%) is consistent with the observations of Kotfis et al. (14), who found that integrating nurse-driven pain assessment tools led to more effective analgesia with reduced opioid dependency.

Pain management outcomes in our study revealed that patients managed by anaesthesia nurses had significantly lower pain scores than those under standard ICU protocols. This aligns with the findings of Asghar et al. (15), who reported that early pain assessment and structured nurse-led analgesia strategies significantly decreased the requirement for high-dose opioid therapy while maintaining effective pain control. Furthermore, Ali et al. (16) emphasized the importance of continuous pain assessment and individualized analgesia plans, key components of the anaesthesia nurse-led approach in our study.

The study also found that anaesthesia nurse-led care was associated with shorter ICU stays (68.9% of patients discharged in <5 days compared to 46.7% in the control group). This is consistent with Shahid et al. (17), who reported that improved sedation and pain control protocols significantly reduced ICU length of stay and improved overall patient recovery rates. Similarly, Malik et al. (18) demonstrated that early intervention and structured pain management reduced the incidence of post-ICU complications and enhanced long-term patient outcomes.

A significant reduction in sedation-related complications, such as delirium and hypotension, was also observed in our study. Only 6.7% of patients in the intervention group experienced such complications, compared to 20.0% in the control group. These findings align with the results of Ahmad et al. (19), who reported that structured sedation monitoring programs significantly decreased the risk of delirium and hemodynamic instability in ICU patients.

Despite these positive findings, some limitations must be acknowledged. The study was conducted in a single tertiary care hospital, limiting its generalizability to other healthcare settings. Additionally, variations in ICU staffing, nurse training levels, and institutional sedation protocols may influence outcomes. Future multicenter studies with larger sample sizes and more extended follow-up periods are recommended to validate further the benefits of anaesthesia nurse-led sedation and pain management in ICU settings.

Conclusion

In conclusion, this study highlights the critical role of anaesthesia nurses in optimizing sedation and pain control in ICU patients. Their involvement leads to better sedation outcomes, improved pain management, shorter ICU stays, and fewer complications. Integrating structured nurse-led sedation and analgesia protocols into ICU care models in Pakistan could help address current gaps in critical care delivery, ultimately improving patient outcomes and optimizing healthcare resource utilization. Further research should focus on developing standardised national guidelines for nurse-led sedation and pain management to enhance ICU care across the country.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-MS-03-24)

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Approved

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The authors declared the absence of a conflict of interest.

Author Contribution

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Manuscript drafting, Study Design,
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Review of Literature, Data entry, Data analysis, and drafting article.
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Conception of Study, Development of Research Methodology Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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