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Evaluation of Sedation Practices and Associated Clinical Outcomes in a Medical Intensive Care Unit: A Retrospective Observational Study

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Abstract

Aim: Sedative and analgesic medications are among the most commonly used agents in the intensive care unit (ICU). This study aimed to evaluate sedation practices and examine associated clinical characteristics among critically ill patients admitted to a medical ICU.

Study Design: This single-center retrospective study was conducted in the medical intensive care unit of a tertiary education and research hospital in Istanbul, Türkiye. Adult patients admitted between March and August 2025 who received continuous sedative–analgesic infusions for at least 24 hours were included. Data were extracted from medical records. Sedation depth was assessed using the Richmond Agitation–Sedation Scale (RASS), and potential drug–drug interactions were evaluated.

Results: Forty-five patients (mean age, 60.0±17.4 years; 51.1% male) were included. Sedation was most commonly initiated to facilitate mechanical ventilation (68.9%). Dexmedetomidine and remifentanil were the most frequently used agents. The mean RASS score (-2.17±1.20) indicated a tendency toward moderate sedation. The median number of potential drug–drug interactions (Lexicomp category D or X) per patient was 2 (interquartile range, 0–4). Antipsychotic use (17.8%) was associated with a higher number of potential drug–drug interactions. ICU length of stay was positively correlated with the duration of mechanical ventilation (ρ=0.889, p<0.001), dexmedetomidine infusion (ρ=0.647, p<0.001), and remifentanil infusion (ρ=0.550, p=0.001).

Conclusions: Although sedative selection was largely consistent with current guideline recommendations, the findings indicate a tendency toward moderate sedation and polypharmacy. Continuous monitoring, structured assessment, and individualized dose titration are essential to optimize sedation quality and improve clinical outcomes in critically ill patients.

Keywords: Analgosedation; Clinical pharmacy; Dexmedetomidine; Drug–drug interactions; Intensive care unit; Remifentanil.

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Introduction

Agitation is common among patients admitted to intensive care units (ICUs) and may result from endotracheal intubation, invasive mechanical ventilation, positioning, pain, fear, anxiety, dyspnea, or delirium. Agitation can lead to adverse outcomes, including self-removal of endotracheal tubes or intravascular catheters, patient–ventilator dyssynchrony, and increased sympathetic activity.[1] Sedative and analgesic agents are among the most frequently used medications in the ICU and play a central role in preventing these complications while improving patient comfort and tolerance of treatment.[2]

Deep sedation has been associated with prolonged mechanical ventilation, longer ICU stays, and increased mortality in multicenter prospective cohort studies.[3,4] Therefore, except in specific clinical situations such as intracranial hypertension, refractory status epilepticus, or prevention of awareness during neuromuscular blockade, unnecessary deep sedation should be avoided in critically ill patients.[1,5] Sedation depth should be assessed regularly using validated instruments such as the Richmond Agitation–Sedation Scale (RASS) or the Sedation–Agitation Scale (SAS) to optimize sedation therapy.[6] No single sedative or analgesic agent has demonstrated clear superiority over others. Instead, drug selection should be individualized according to pharmacokinetic properties, potential drug–drug interactions, organ function, drug availability, and cost.[2] Because benzodiazepines are associated with delirium and other adverse effects, their routine use is discouraged except when clearly indicated, such as for status epilepticus or alcohol withdrawal.[7]

Pain is another major contributor to agitation in critically ill patients. Approximately 71% of patients discharged from the ICU report experiencing moderate to severe pain during their ICU stay.[1] Untreated pain may lead to increased energy expenditure, oxygen consumption, hypercoagulability, and immune dysfunction in the short term, while post-traumatic stress disorder may develop in the long term.[2] Therefore, routine pain assessment and adequate analgesia are fundamental components of intensive care. Because pain is subjective experience, patient self-report remains the gold standard for pain assessment. However, pain assessment is particularly challenging in critically ill patients who are unable to communicate. The 2018 PADIS (Pain, Agitation/Sedation, Delirium, Immobility, and Sleep) guidelines recommend the Numerical Rating Scale (NRS) or Visual Analog Scale (VAS) for communicative patients and behavioral assessment tools, such as the Behavioral Pain Scale (BPS) or the Critical-Care Pain Observation Tool (CPOT), for patients unable to communicate.[6]

Because pain is highly prevalent in the ICU, initiating sedative therapy without first assessing pain may mask the underlying cause of agitation and is generally considered inappropriate. Conversely, administering high doses of analgesics solely to achieve sedation may increase the risk of dose-dependent adverse effects. Accordingly, an analgesia-first (analgosedation) approach, in which analgesia is prioritized before or alongside sedation, is recommended to maximize patient comfort while minimizing medication-related adverse effects.[8] To reduce opioid-related adverse effects, multimodal analgesia incorporating adjunctive agents such as acetaminophen, ketamine, or dexmedetomidine is recommended, as opioids are often the first-line agents for pain management.[9]

In routine ICU practice, achieved sedation depth often differs from guideline-recommended targets, and the distribution of Richmond Agitation–Sedation Scale scores may have important implications for clinical outcomes.[1,2] Additionally, critically ill patients receiving continuous sedative and analgesic infusions are particularly susceptible to potential drug–drug interactions because of polypharmacy, altered pharmacokinetics, and the frequent use of multimodal therapeutic regimens.[2] Although comprehensive guidelines are available, real-world data describing sedation and analgosedation practices—particularly regarding achieved sedation depth and the burden of potential drug–drug interactions—remain limited. A better understanding of these practices from a clinical pharmacy perspective may help optimize sedation management and improve patient-centered care. Therefore, this study aimed to evaluate sedation practices and examine associated clinical characteristics in patients receiving continuous sedative therapy in a medical ICU.

Materials and Methods

Study Design and Participants

This single-center retrospective study was conducted in the medical intensive care unit of a tertiary education and research hospital in Istanbul, Türkiye. At the time of the study, no formal written sedoanalgesia protocol had been

implemented in the unit. Sedative and analgesic management was individualized and guided by daily clinical assessment. Drug selection and dose titration were based on the underlying indication (mechanical ventilation or agitation), patient response, and target RASS scores, in accordance with current guideline recommendations. The medical and electronic health records of adult patients (≥18 years) admitted to the ICU between March 1 and August 31, 2025, were retrospectively reviewed.

Patients who did not require continuous deep sedation and who received at least one sedative–analgesic agent by continuous infusion for at least 24 hours were eligible for inclusion. Patients with indications for continuous deep sedation (e.g., intracranial hypertension, refractory status epilepticus, or treatment with neuromuscular blocking agents), those with incomplete or missing medication records, and those with an ICU stay of less than 24 hours were excluded.

Data Collection

Data were collected retrospectively from the hospital information management system and patients' medical records. Demographic variables included age, sex, body mass index (BMI), presence and number of chronic diseases, Charlson Comorbidity Index (CCI), and Clinical Frailty Scale (CFS). Clinical variables included the primary reason for ICU admission, ICU length of stay, discharge status, duration of mechanical ventilation, duration of continuous renal replacement therapy (CRRT), presence of acute kidney injury (AKI), Acute Physiology and Chronic Health Evaluation II (APACHE II) score, Sequential Organ Failure Assessment (SOFA) score, and Glasgow Coma Scale (GCS) score. APACHE II scores were calculated using the worst recorded values within the first 24 hours after ICU admission, whereas SOFA and GCS scores were recorded at the time of ICU admission.

Sedative and analgesic treatment data included the agents administered, indications for treatment initiation, use of combination regimens, infusion duration, and cumulative and unit doses of each medication. The primary sedative and analgesic agents were defined according to the predominant continuous infusion administered during the ICU stay. Sedation and pain assessments included Richmond Agitation–Sedation Scale, Full Outline of UnResponsiveness (FOUR) score, Behavioral Pain Scale (BPS), and Visual Analog Scale, where applicable. For each patient, all recorded assessment scores during the ICU stay were reviewed retrospectively, and the mean values during the sedation period were used for analysis. RASS scores between −2 and −3 were considered indicative of moderate sedation, whereas scores ≤−4 were classified as deep sedation.

Drug-related variables included the total number of medications prescribed within the first 24 hours after ICU admission, antipsychotic use, and potential drug–drug interactions. Potential drug–drug interactions were evaluated using the Lexicomp® database.[10] and classified as category D (therapy modification recommended) or category X (combination should be avoided). Additional clinical data included the occurrence of constipation, defined as the absence of defecation for at least three consecutive days.

Study Outcomes

Primary Outcome

The primary outcome was the evaluation of sedation practices, including the initial indication for sedation (mechanical ventilation or agitation), selection of specific pharmacological regimens (e.g., dexmedetomidine monotherapy or multimodal combinations), and the depth of sedation achieved, as measured by the mean RASS and FOUR scores.

Secondary Outcomes

The secondary outcomes were the number of potential drug–drug interactions per patient and factors associated with ICU length of stay, including its relationship with the duration of mechanical ventilation and continuous sedative infusions.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics (version 27.0; IBM Corp., Armonk, NY, USA). The normality of continuous variables was assessed using the Shapiro–Wilk test. Data are presented as mean ± standard deviation for normally distributed variables, median (interquartile range) for non-normally distributed variables, and frequency (percentage) for categorical variables.

Comparisons between groups were performed using the independent-samples t test for normally distributed variables and the Mann–Whitney U test for non-normally distributed variables. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Correlations between continuous variables were assessed using Spearman's rank correlation coefficient (ϱ). A two-tailed p value <0.05 was considered sta-

tistically significant.

Ethical Considerations

The study protocol was reviewed and approved by Marmara University Faculty of Medicine Non-Drug and Medical Device Research Ethics Committee (Approval Number: 09.2025-25-0836, Date: 26.09.2025). The study was conducted in accordance with the principles of the Declaration of Helsinki. Because of the retrospective study design, the requirement for informed consent was waived by the Ethics Committee.

Results

After screening all patients admitted between March 1 and August 31, 2025, who met the eligibility criteria, 45 patients were included in the final analysis (Fig. 1). The mean age of the study population was 60.0±17.4 years, and 51.1% were male. Demographic and clinical characteristics are summarized in Table 1.

The most common indication for initiating sedation was mechanical ventilation (68.9%). Dexmedetomidine was the most frequently used agent as monotherapy. Medication-related data and assessment scores are presented in Table 2.

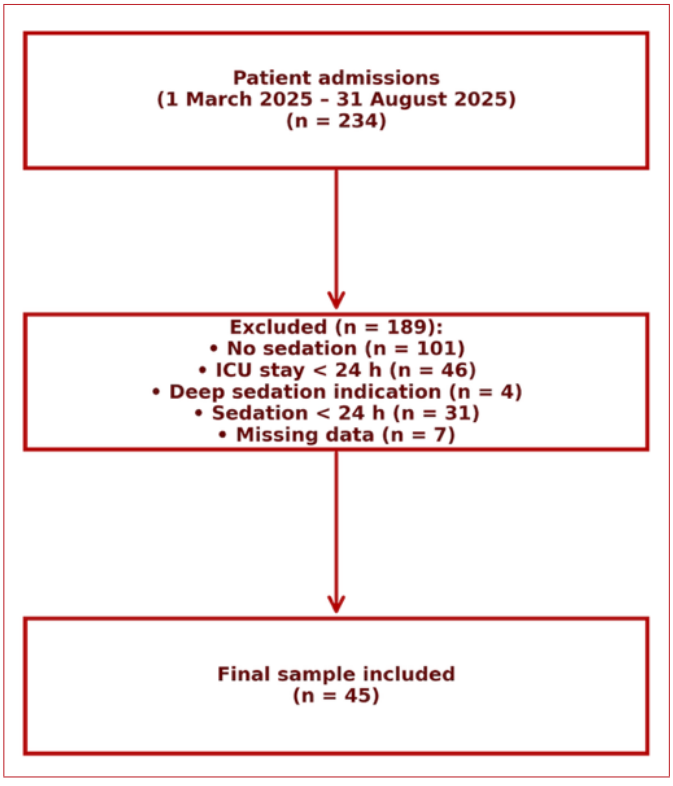

Figure 1. Flowchart of patient selection.

Table 1. Demographic and clinical characteristics of the study population (n=45)

Variable	
Age (years), mean±SD	60.0±17.4
Sex (male), n (%)	23 (51.1%)
BMI (kg/m²), median (IQR)	23.6 (21.4–26.8)
Number of comorbidities, mean±SD	2.9±1.9
Charlson Comorbidity Index, mean±SD	4.5±3.2
Total number of medications at ICU admission, mean±SD*	12.0±3.4
Clinical Frailty Scale, mean±SD	5.7±2.1
APACHE II score, mean±SD	24.4±7.1
SOFA score, mean±SD	8.9±3.7
GCS score, mean±SD	9.2±4.6
Acute kidney injury, n (%)	30 (66.7%)
CRRT use, n (%)	19 (42.2%)
Duration of CRRT (days), mean±SD	10.8±7.6
Mechanical ventilation use, n (%)	34 (75.6%)
Duration of mechanical ventilation (days), mean±SD	12.0±9.8
ICU length of stay (days), median (IQR)	11.0 (5.0–16.0)
ICU mortality, n (%)	26 (57.8%)

Data are presented as mean±standard deviation (SD), median (IQR) or number (%). *The total number of medications at ICU admission was defined as all medications prescribed within the first 24 hours after ICU admission. BMI: Body mass index; CRRT: Continuous renal replacement therapy; GCS: Glasgow Coma Scale; ICU: Intensive care unit; SOFA: Sequential Organ Failure Assessment.

A total of 112 potential drug–drug interactions were identified during the study period. Of these, 18 were classified as category X (combination should be avoided), and the remaining 94 were classified as category D (therapy modification recommended), according to the Lexicomp® database. The median number of potential drug–drug interactions per patient was 2 (interquartile range [IQR], 0–4), with category D interactions occurring most frequently. Representative examples of potential drug–drug interactions and their observed frequencies are summarized in Table 3.

Constipation lasting ≥3 days occurred in 35.6% of patients during remifentanil infusion. Compared with patients who did not develop constipation, those who developed constipation had a significantly longer total duration of remifentanil treatment [161.5 (115.3–289.3) vs. 29.0 (19.0–59.0) hours; p<0.001] and a higher cumulative remifentanil dose [3133.0 (1431.0–5428.6) vs. 270.0 (188.3–744.8) mcg/kg; p<0.001]

Patients who received sedation for mechanical ven-

Table 2. Sedation practices, regimens, and medication exposure

Parameter	
Indication for sedation – mechanical ventilation, n (%)	31 (68.9%)
Indication for sedation – agitation, n (%)	14 (31.1%)
Predominant sedative agent – dexmedetomidine, n (%)	21 (46.7%)
Predominant analgesic agent – remifentanil, n (%)	5 (11.1%)
Two-drug regimen, n (%)	16 (35.6%)
Three-drug regimen, n (%)	2 (4.4%)
Dexmedetomidine infusion duration (hours), median (IQR)	87.0 (40.5–178.0)
Remifentanil infusion duration (hours), median (IQR)	109.0 (29–198)
Ketamine infusion duration (hours), median (IQR)	38.5 (22.3–137.3)
Propofol infusion duration (hours), median (IQR)	74.0 (69.3–116.8)
Remifentanil infusion rate (mcg/kg/min), median (IQR)	0.200 (0.100–0.300)
Dexmedetomidine infusion rate (mcg/kg/h), median (IQR)	0.200 (0.200–0.525)
Ketamine infusion rate (mg/h), median (IQR)	62.5 (33.7–119.6)
Propofol infusion rate (mg/h), median (IQR)	100.4 (72.8–114.6)
Mean RASS score, mean±SD	–2.17±1.20
Mean FOUR score, mean±SD	10.6±4.1
Mean BPS score, mean±SD	2.90±0.59
Mean VAS score, mean±SD	0.15±0.37
Antipsychotic use, n (%)	8 (17.8%)

BPS: Behavioral Pain Scale; CRRT: Continuous renal replacement therapy; FOUR: Full Outline of UnResponsiveness; MV: Mechanical ventilation; RASS: Richmond Agitation–Sedation Scale; VAS: Visual Analog Scale. **Note:** Remifentanil was classified as an analgesic agent rather than a sedative. Predominant sedative and analgesic agents refer to the primary continuously infused agents used as the backbone of the sedation regimen during ICU follow-up, whereas additional agents could be added as part of a multimodal sedation strategy. Accordingly, the predominant analgesic category includes only patients in whom remifentanil served as the primary analgesic infusion, although it was more commonly administered as a component of multimodal analgosedation. Two- and three-drug regimens refer to the concurrent use of two or three continuously infused sedative and/or analgesic agents during ICU follow-up.

tilation had higher disease severity scores, including APACHE II and SOFA scores, deeper levels of sedation, and lower consciousness scores than patients who received sedation for agitation. Antipsychotic use was associated with a greater comorbidity burden, longer dexmedetomidine infusion duration, and a higher number of potential drug–drug interactions. Comparisons between the main clinical subgroups are summarized in Table 4.

Intensive care unit length of stay was positively correlated with the durations of mechanical ventilation, remifentanil infusion, and dexmedetomidine infusion. Correlation analyses are presented in Table 5.

Discussion

This study evaluated sedation practices, potential drug–drug interactions, and associated clinical characteristics in ICU patients. Mechanical ventilation was the most common indication for sedative–analgesic therapy. Dexmedetomidine and remifentanil were commonly used, often as part of multimodal regimens. A tendency toward moderate sedation and a higher number of potential drug–drug interactions among patients receiving antipsychotics were also observed.

The most common indication for initiating sedative–analgesic therapy was mechanical ventilation. This finding is consistent with previous reports indicating that intravenous sedatives are initiated in up to 85% of ICU patients receiving mechanical ventilation.[11, 12] The high proportion of patients who required mechanical ventilation in the present study likely explains the frequent use of sedative–analgesic medications to alleviate pain, anxiety, and agitation associated with mechanical ventilation and to facilitate treatment. The frequent use of remifentanil and dexmedetomidine in sedation regimens, likely reflecting their analgesic efficacy,[1] suggests the adoption of an analgesia-first approach in the ICU. Remifentanil was the most frequently used opioid for continuous analgesia in this study. However, it was more often administered as part of multimodal analgosedation than as the sole predominant agent. It therefore served as the primary analgesic infusion in only five patients (11.1%) (Table 2), whereas dexmedetomidine, which also has analgesic properties, was more often the predominant continuously infused agent. Remifentanil's metabolism by plasma esterases, lack of requirement for dose adjustment in organ failure, rapid onset, short duration of action, and ease of titration make it well suited for use in ICU practice.[13-15] The median remifentanil infusion rate in this study was consistent with the dose range recommended in the PADIS guidelines (0.008–0.250 μg/kg/min).[2,6] The low behavioral and visual pain scores suggest that pain was generally well controlled during ICU follow-up. Constipation occurred in 35.6% of patients during the study period. Compared with patients without constipation, those who developed constipation had a significantly longer remifentanil infusion duration

Table 3. Representative examples and frequencies of potential drug–drug interactions identified in the study

Interacting drug pair	Category	Mechanism	n (%)
Amiodarone + olanzapine	D	Additive QTc prolongation	2 (4.4)
Bisoprolol + dexmedetomidine	D	Additive risk of bradycardia and AV block	6 (13.3)
Quetiapine + metoclopramide	X	Additive antidopaminergic effects	2 (4.4)
Domperidone + propofol	X	Additive QTc prolongation	2 (4.4)
Remifentanil + tramadol	D	Additive CNS depression	5 (11.1)
Patient-level prevalence of pDDIs			
Patients with ≥1 interaction	D	-	32 (71.1)
Patients with ≥2 interactions	D	-	26 (57.8)
Patients with ≥3 interactions	D	-	17 (37.8)
Patients with ≥1 interaction	X	-	10 (22.2)
Patients with ≥2 interactions	X	-	5 (11.1)
Patients with ≥3 interactions	X	-	3 (6.7)

Note: The interactions shown are representative examples and do not necessarily represent the most frequent interactions identified in the cohort. Frequencies indicate the number and percentage of patients in whom each interaction was identified (N=45). Values in the patient-level prevalence section represent unique patients meeting each threshold rather than the total number of interaction pairs.
AV: Atrioventricular; CNS: Central nervous system; pDDI: Potential drug–drug interaction; Category D: Therapy modification recommended; Category X: Combination should be avoided.

Table 4. Comparisons between major clinical subgroups

Variable	Comparative groups		p
Sedation indication	Mechanical ventilation (n=31)	Agitation (n=14)	
APACHE II score, mean±SD	26.5±7.0	19.9±6.2	0.003
SOFA score, mean±SD	9.8±3.4	6.7±3.1	0.007
GCS score, mean±SD	8.1±3.9	11.9±4.2	0.009
RASS score, mean±SD	–2.68±0.90	–0.90±1.00	<0.001
Antipsychotic use	Users (n=8)	Non-users (n=37)	
Dexmedetomidine infusion duration (h), median (IQR)	164.7 (113.2–239.5)	69.4 (43.1–111.9)	0.004
Number of potential drug–drug interactions, mean±SD	4.6±2.8	2.0±1.9	0.002
Number of comorbidities, mean±SD	4.4±1.5	2.6±1.8	0.013

APACHE: Acute Physiology and Chronic Health Evaluation; SOFA: Sequential Organ Failure Assessment; GCS: Glasgow Coma Scale; RASS: Richmond Agitation–Sedation Scale.

[161.5 (115.3–289.3) vs. 29.0 (19.0–59.0) hours] and a higher cumulative remifentanil dose [3133.0 (1431.0–5428.6) vs. 270.0 (188.3–744.8) mcg/kg] (both $p<0.001$). These findings suggest that prolonged opioid exposure may increase the risk of gastrointestinal dysmotility, even when opioids are administered within recommended dose ranges. The dose- and duration-related adverse effects of opioids support the use of multimodal analgesic strategies that incorporate agents such as acetaminophen, dexmedetomidine, or low-dose ketamine as part of multimodal analgesia.[16, 17]

Dexmedetomidine was another agent frequently used as monotherapy. Compared with benzodiazepines, dexmedetomidine has advantages in delirium management and is associated with lighter, more arousable sedation, which has supported its increasing use in the ICU, particularly for agitation management.[1, 18, 19] In our cohort, antipsychotic use was more frequent among patients receiving dexmedetomidine. Although some studies have reported that dexmedetomidine reduces the need for antipsychotic therapy, our finding may reflect the complexity of real-world ICU practice. In clinical settings, dex-

Table 5. Correlation analyses

Variables	Spearman's ρ	p
ICU length of stay ↔ MV duration	0.889	<0.001
ICU length of stay ↔ remifentanil infusion duration	0.550	0.001
ICU length of stay ↔ dexmedetomidine infusion duration	0.647	<0.001
ICU length of stay ↔ cumulative remifentanil dose	0.443	0.011
ICU length of stay ↔ cumulative dexmedetomidine dose	0.473	0.003
RASS score ↔ FOUR score	0.727	<0.001

FOUR: Full Outline of UnResponsiveness; ICU: Intensive care unit; MV: Mechanical ventilation; RASS: Richmond Agitation–Sedation Scale.

medetomidine is often used in patients with persistent agitation or delirium, who may already be more likely to require additional antipsychotic treatment. Therefore, this association may reflect greater patient complexity rather than reduced dexmedetomidine efficacy. The association between longer dexmedetomidine infusion duration and antipsychotic use further suggests that dexmedetomidine was commonly used for agitation management. The reported prevalence of antipsychotic use in ICU patients is 11.8%,[20] compared with 17.8% in the present study. Although antipsychotics are not routinely recommended in the ICU, they may be used in selected patients with severe agitation or delirium when nonpharmacological measures and optimized analgesia–sedation strategies are insufficient.[6] Antipsychotics may also increase the risk of drug–drug interactions.[21, 22] In the present study, antipsychotic use was associated with a higher number of potential drug–drug interactions. This may be related to additive central nervous system depression and QT-interval prolongation when antipsychotics are combined with other medications. Despite the high frequency of potential drug–drug interactions, not all interactions are clinically significant. Furthermore, the concurrent use of sedative–analgesic agents as part of a multimodal approach may also result in additive central nervous system depressant effects. These findings highlight the importance of evaluating the clinical relevance of drug combinations in ICU practice and the potential contribution of clinical pharmacists to multidisciplinary care.[23] The association between antipsychotic use and a greater comorbidity burden (p=0.013) is also consistent with previous reports linking multimorbidity to delirium and agitation.[24, 25]

Beyond patient-level factors such as antipsychotic exposure, the overall burden of potential drug–drug interactions in our cohort merits comparison with previously published ICU studies. Potential drug–drug interactions are common in critically ill patients admitted to intensive care units because of the frequent use of multiple medications.[23] For example, previous studies have reported a high prevalence of potential drug–drug interactions in ICU patients, largely attributable to polypharmacy. A retrospective study from Brazil found a prevalence of potential drug–drug interactions (pDDI) of approximately 70%, and the number of potential drug–drug interactions was positively correlated with the number of medications prescribed.[26] Another study conducted in Türkiye found that at least one pDDI was present in 81.9% of ICU patients, with moderate and severe interactions occurring particularly frequently.[27] In the present study, 112 potential drug–drug interactions were identified among 45 critically ill patients, with a median of 2 interactions per patient (IQR, 0–4), including Lexicomp category D and X interactions. The concomitant use of remifentanil and tramadol, both opioid analgesics, may represent a potentially inappropriate or controversial prescribing practice. Although this combination is not considered a standard or recommended analgesic approach, it may occur in real-world ICU settings. Its presence in our cohort highlights potential drug-related problems and underscores the importance of identifying inappropriate or suboptimal pharmacological practices. This finding further emphasizes the need for careful medication review and optimization in critically ill patients.

Patients who received sedation for mechanical ventilation had significantly higher APACHE II scores, suggesting that greater disease severity was associated with the need for deeper sedation. This finding is consistent with previous reports indicating that mechanically ventilated patients may require deeper sedation to facilitate ventilator synchrony and prevent agitation-related complications.[28] However, prolonged or excessive sedation has been associated with longer mechanical ventilation duration and prolonged intensive care unit stay.[1, 29] Therefore, although deeper sedation may be clinically justified in some mechanically ventilated patients, structured sedation assessment, daily sedation interruption when appropriate, and target-directed dose titration are needed to avoid unnecessary oversedation. In contrast, lower patients who received sedation for agitation had lighter sedation levels, with a mean RASS score of -0.90. This is

more consistent with current recommendations favoring light, arousable sedation.[30] Taken together, these findings support individualized sedation strategies guided by validated assessment scales.

Correlation analyses showed that longer ICU stays were strongly associated with prolonged mechanical ventilation and longer exposure to sedative–analgesic infusions. These relationships are consistent with previous studies reporting associations between prolonged sedation exposure and clinical outcomes in critically ill patients. Previous evidence has also shown that the depth and duration of sedation are important determinants of these outcomes.[31] These correlations may reflect the greater clinical complexity and prolonged treatment requirements of critically ill patients and underscore the importance of careful sedation assessment and monitoring.[32]

This study has certain limitations. First, its single-center and retrospective design limits the generalizability of the findings. Second, the relatively small sample size precluded the evaluation of mortality and other clinical outcomes and did not permit causal inferences. Third, delirium was not formally assessed. Finally, potential drug–drug interactions were identified using a database and were not classified according to their observed clinical significance. Despite these limitations, the study has several key strengths. It provides real-world data on sedation practices and potential drug–drug interactions in critically ill patients. The analysis included multiple sedative agents, dosing patterns, and their associations with ICU outcomes. Additionally, the study incorporated objective sedation and pain assessment measures and highlighted the potential contribution of clinical pharmacists to sedation management.

Conclusion

Taken together, our findings provide a real-world overview of sedation management in critically ill patients. Sedation practice in this tertiary ICU was characterized by a tendency toward moderate sedation and prolonged exposure to sedative agents. Longer durations of mechanical ventilation and sedative infusion were correlated with longer ICU stays. The predominant use of dexmedetomidine and remifentanil was broadly consistent with current guideline-recommended approaches, whereas the use of propofol, ketamine, and antipsychotics reflected individualized multimodal management. The findings also demonstrated a substantial burden of potential drug–drug interactions, particularly among patients receiving antipsychotics. Prospective multicenter studies are needed to confirm these observations and determine whether structured sedation protocols incorporating clinical pharmacist involvement can improve the safety and quality of sedation management.

Ethics Committee Approval: Ethics committee approval was obtained from Marmara University Faculty of Medicine Non-Drug and Medical Device Research Ethics Committee (Approval Number: 09.2025-25-0836, Date: 26.09.2025).

Informed Consent: Due to the retrospective design of the study, written informed consent from patients and/or their legal representatives could not be obtained.

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