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Effect of Preoperative Sleep Quality on Incidence of Propofol Induced Emergence Delirium on Patients Undergoing Laparoscopic Cholecystectomy under General Anesthesia

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ABSTRACT

Introduction: The postoperative emergence delirium complication occurs frequently in patients who receive general anesthesia procedures while poor sleep quality during the preoperative period may increase its frequency. The research evaluated how preoperative sleep quality would affect the emergence delirium development in patients receiving propofol anesthesia during laparoscopic cholecystectomy operations. **Methodology:** The research took place at Combined Military Hospital (CMH), Peshawar, where investigators studied 118 patients who received laparoscopic cholecystectomy procedures from April 2023 to March 2024. We used the Pittsburgh Sleep Quality Index (PSQI) for sleep quality evaluation prior to surgery and the Richmond Agitation-Sedation Scale (RASS) for delirium assessment in patients following anesthesia in the post-anesthesia care unit (PACU). The research used chi-square tests and independent t-tests and logistic regression for statistical analysis to explore the connection between poor sleep quality and emergence delirium rates. **Result:** Results showed patients with poor sleep quality according to PSQI scoring had a substantially higher emergence delirium occurrence rate of 40.7% when compared to 14.1% among other participants ($p<0.001$). The patients with poor sleep quality experienced higher RASS scores (2.8 ± 0.6 vs. 1.9 ± 0.5, $p<0.001$) along with longer emergence times (10.2 ± 3.1 min vs. 8.7 ± 2.4 min, $p=0.012$) and they required more time in the PACU (49.2 ± 10.1 min vs. 42.7 ± 8.4 min, $p=0.004$). The results of logistic regression testing indicated that poor sleep quality acted as a separate variable that significantly predicted emergence delirium with an OR of 1.87 ($p=0.002$). **Conclusion:** The quality of patient sleep during the period before surgery strongly influences the probability of emergence delirium occurring from propofol anesthesia during laparoscopic cholecystectomy operations. Patient recovery following surgery becomes optimized when they receive better sleep care prior to their operation because it lowers their risk of emergence delirium.

INTRODUCTION

Authorized medical literature states that ED remains a known postoperative condition leading to confusion while also causing agitation and disorientation and heightened perception immediately following general anesthesia recoveries [1]. ED manifests most often during short-acting anesthesia treatment with propofol despite the drug's fast onset and recovery benefits because propofol shows increased risk for brief neurocognitive issues [2]. Every patient experiences ED symptoms differently as they might display either restlessness and combativeness with emotional distress or hallucinations [3]. While this condition normally resolves independently it produces various noteworthy clinical problems by causing patients to hurt themselves and unintentionally detach medical equipment such as IV lines and breathing tubes and increase pain severity and extend postoperative observation time [4]. The complications from ED lead to both safety risks for patients alongside resource strain and extra workloads for healthcare providers.

Patients experience ED because of various elements including demographic factors and pre-operation anxious feelings along with the primary condition and overall cognitive status at baseline as well as the duration and type of anesthesia administered and how providers handle postoperative pain [5]. Preoperative sleep quality continues to be extensively studied because it impacts the way neurocognitive outcomes transform after surgical procedures. Human beings need sleep as their basic physiological process since this ensures cognitive functions and emotional stability and total life satisfaction [6]. The brain function deteriorates because of poor sleep quality which develops from primary sleep disorders as well as preoperative anxiety and hospitalization-related stress and underlying medical conditions therefore increasing perioperative complication risks [7]. Scientific studies have confirmed that a lack of restful sleep enhances stress reactions while causing increased body inflammation and oxidative damage to cells plus GABA and dopamine and serotonin imbalances that affect anesthesia response [8].

Laparoscopic cholecystectomy stands as one of the most executed surgical treatments for gallbladder disease where the main compound used for anesthesia is propofol when performing the procedure under general anesthesia [9]. Laparoscopic cholecystectomy leads to superior patient results than open cholecystectomy through minimized postoperative pain and reduced hospitalization duration followed by shortened recovery times [10]. The administration of general anesthesia creates the possibility of PIED among patients who enter the procedure with poor preoperative sleep quality or other existing medical vulnerabilities. The patients undergoing laparoscopic cholecystectomy operations show signs of sleep problems because they experience preoperative anxiety and gallbladder pain symptoms as well as hospital stress [11]. The knowledge of how preoperative sleep quality affects PIED incidence can assist medical professionals in selecting patients at risk and create specific perioperative treatments including enhanced sleep practices and anti-anxiety drugs and different anesthesia strategies.

Research exploring the direct connection between sleep disturbances and Post-Intensive Care Syndrome exists in minimal quantities. Most existing studies on emergence delirium focus on broader risk factors, such as age, preexisting cognitive impairment, and anesthetic techniques, without specifically addressing sleep as a modifiable variable. Moreover, while sleep deprivation has been linked to increased delirium risk in critically ill and elderly patients, its role in otherwise healthy individuals undergoing elective surgery is less well understood. Addressing this gap, our study aims to investigate the effect of preoperative sleep quality on the incidence of propofol-induced emergence delirium in patients undergoing laparoscopic cholecystectomy under general anesthesia.

METHODOLOGY

Study Design and Setting

This prospective observational study was conducted at the Department of Anesthesiology, Combined Military Hospital (CMH), Peshawar. The study duration spanned one year starting from April 2023 to March 2024. Healthcare providers selected patients undergoing planned laparoscopic cholecystectomy under general anesthesia from the surgical units of the hospital. The research team gathered information at two points to determine any connections between patients' sleep quality before surgery and their chance of developing emergence delirium after receiving Propofol. The main purpose of this research was to evaluate if inadequate preoperative sleep affects the chance for patients to develop Propofol-induced emergence delirium after general anaesthesia for laparoscopic cholecystectomy.

Sample Size Calculation

The researchers used OpenEpi software to determine the sample size by defining 95% confidence and an expected 20% incidence of emergence delirium from previous studies and a precision of 5%. Based on these specified factors OpenEpi calculated that 118 patients represented the lowest number needed for proper statistical power. An extra number of participants underwent screening for potential dropouts while ensuring the enrolled patients fulfilled all inclusion requirements.

Inclusion and Exclusion Criteria

Patients who received general anesthesia for laparoscopic cholecystectomy waited for their surgery date underwent evaluation for entry into the study. Adult patients aged 18 to 60 with an ASA physical status rating of I or II who were having laparoscopic cholecystectomy with propofol induction could enroll if they held capacity for informed consent. The study excluded patients who had psychiatric or neurological disorders along with regular sedative or hypnotic use or antidepressants and severe hepatic or renal problems as well as history of substance abuse or BMI higher than 35 kg/m² or any prior procedures that resulted in emergence delirium.

Preoperative Sleep Quality Assessment

The PSQI tool served as the assessment of preoperative sleep quality to evaluate subjective sleep disturbances during the previous month among patients. The patients received PSQI evaluation to allocate them in two groups according to their sleep quality results where PSQI score ≤ 5 indicated good sleep quality and PSQI score >5 showed poor sleep quality. The preoperative assessment occurred during the one-day period before surgery at the anesthetic visit.

Anesthetic Protocol

Standard preoperative fasting protocols together with institutional-approved medications were provided to all patients according to established regulations. Standard operating procedure monitoring started after patients entered the operating room where electrocardiography (ECG) and non-invasive blood pressure and pulse oximetry systems became active. The surgeon induced general anesthesia through an intravenous propofol (2 mg/kg) administration together with fentanyl (1 µg/kg) and atracurium (0.5 mg/kg) to enable endotracheal intubation. Anesthesia was maintained with sevoflurane (1.5–2%) in oxygen and air, with intermittent doses of atracurium. Mechanical ventilation was adjusted to maintain normocapnia. No additional sedatives or hypnotics were administered intraoperatively.

Assessment of Emergence Delirium
Emergence delirium was evaluated using the RASS in the PACU. Patients were monitored immediately upon emergence from anesthesia and at 5-minute intervals for the first 30 minutes. Emergence delirium was defined as a RASS score of +2 or higher, indicating agitation or combative behavior. Patients were subsequently categorized into two groups based on the presence or absence of PIED.

Statistical Analysis
Version 26 of SPSS was used for statistical analysis. The Kolmogorov-Smirnov test was used to determine whether continuous variables were normal. The Mann-Whitney U test was used to assess non-normally distributed data, whereas independent ttests were used to compare regularly distributed variables, which were presented as mean ± standard deviation. Frequencies and percentages were used to express categorical data, and the chi-square or Fisher's exact test was used to evaluate group differences. After controlling for confounding variables, logistic regression analysis was used to find independent predictors of emerging delirium. The association between PSQI scores and the severity of delirium was evaluated using Pearson's or Spearman's correlation. The best PSQI threshold for emerging delirium prediction was found using a receiver operating characteristic (ROC) curve analysis, with $p < 0.05$ designated as the statistical significance level.

Ethical Approval
The Institute's Institutional Review Board gave its approval to this study prior to the start of data collecting. All participants were informed of the study's goals, methods, and any dangers before providing their written informed permission. All procedures were carried out in compliance with the Declaration of Helsinki, and patient data confidentiality was preserved throughout the study. Participants were free to leave the trial at any time without facing any repercussions for their medical treatment.

RESULTS

The study included 118 individuals who were undergoing elective laparoscopic cholecystectomy under general anesthesia. The participants' ages ranged from 25 to 65 years old, with a mean age of 42.6 ± 10.8 years. There were 62 (52.5%) females and 56 (47.5%) males in the gender distribution. The BMI was 26.3 ± 3.7 kg/m² on average. Of the participants, 40 (33.9%) had a history of smoking, and 78 (66.1%) did not smoke. There was no significant difference in the sleep quality groups (p = 0.217), and the mean preoperative anxiety score, as determined by the Amsterdam Preoperative Anxiety and Information Scale (APAIS), was 12.8 ± 4.2. According to independent t-tests and chi-square tests, there were no statistically significant differences between the two groups in terms of demographic factors, including age (p = 0.238), gender (p = 0.572), BMI (p = 0.481), or smoking status (p = 0.663). As shown in table 1.

Table 1
Baseline Characteristics of Study Participants

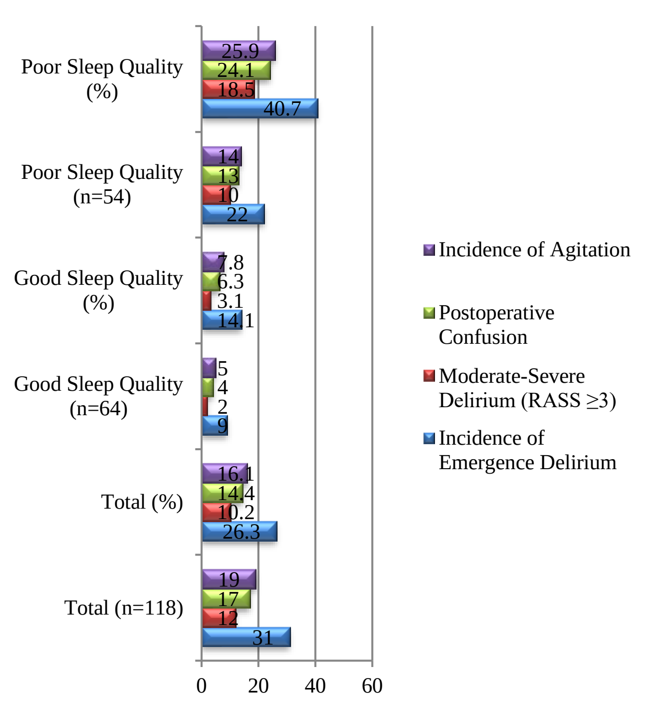
Variable	Total (n=118)	Good Sleep Quality (n=64)	Poor Sleep Quality (n=54)	p-value
Age (years, mean ± SD)	42.6 ± 10.8	41.9 ± 10.5	43.5 ± 11.1	0.238
Gender (Male/Female)	56/62	30/34	26/28	0.572
BMI (kg/m², mean ± SD)	26.3 ± 3.7	26.1 ± 3.5	26.6 ± 3.9	0.481
Smoking Status (Yes/No)	40/78	21/43	19/35	0.663
APAIS Score (mean ± SD)	12.8 ± 4.2	12.5 ± 3.9	13.2 ± 4.4	0.217
PSQI Score (mean ± SD)	7.2 ± 3.1	5.4 ± 2.1	9.3 ± 2.6	<0.001
Hypertension (%)	29 (24.6%)	13 (20.3%)	16 (29.6%)	0.274
Diabetes Mellitus (%)	22 (18.6%)	10 (15.6%)	12 (22.2%)	0.389

According to the Richmond Agitation-Sedation Scale (RASS ≥ +2), 31 (26.3%) of the 118 individuals experienced emerging delirium. Nine (14.1%) of the patients with high preoperative sleep quality (PSQI ≤5) had emergence delirium, whereas 22 (40.7%) of the patients with poor sleep quality (PSQI >5) did. The chi-square test revealed a statistically significant difference in incidence between these two groups ($p < 0.001$).

The severity of emergence delirium was also assessed using the RASS scores in the PACU. Patients in the poor sleep quality group had significantly higher mean RASS scores (2.8 ± 0.6) compared to those in the good sleep quality group (1.9 ± 0.5) ($p < 0.001$, independent t-test). Subgroup analysis revealed that moderate-to-severe delirium (RASS score ≥3) was observed in 10 (18.5%) patients from the poor sleep quality group, whereas moderate to severe delirium was experienced by only 2 (3.1%) patients in the group with high sleep quality. (p = 0.007, chi-square test). As shown in figure 1.

Figure 1

Incidence and Severity of Emergence Delirium



The average surgery time was 58.4 ± 10.2 minutes, and there was no statistically significant difference between the groups (p = 0.612). Both groups received similar amounts of propofol (p = 0.483), with an average total dose of 178.6 ± 25.3 mg given during induction and maintenance of anesthesia. However, the mean emergence duration (the time from stopping anesthesia to opening the eyes) was significantly longer in patients with poor sleep quality (10.2 ± 3.1 minutes) than in the group with good sleep quality (8.7 ± 2.4 minutes) (p = 0.012, Mann-Whitney U test).

Using the Riker Sedation-Agitation Scale (SAS), post-extubation agitation levels were evaluated in addition to the emergence duration. In the group with poor sleep quality, the mean SAS score was 5.4 ± 0.8, which was substantially higher than the 4.6 ± 0.7 in the group with good sleep quality (p < 0.001, independent t-test). This indicates a greater likelihood of agitation in patients with poorer sleep quality. As shown in table 2.

Table 2

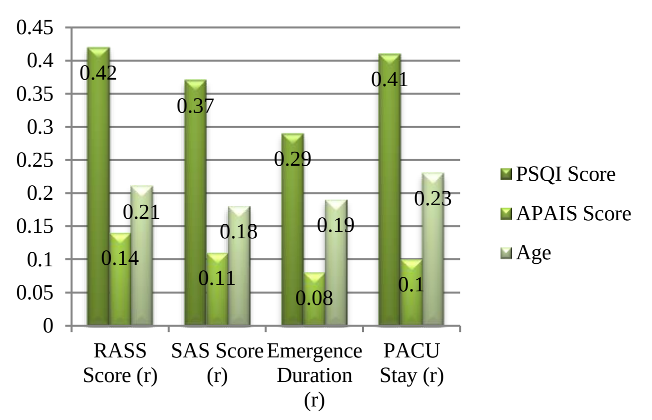
Perioperative Parameters and Recovery Outcomes

Variable	Total (n=118)	Good Sleep Quality (n=64)	Poor Sleep Quality (n=54)	p-value
Surgery Duration (min, mean ± SD)	58.4 ± 10.2	58.1 ± 9.8	58.9 ± 10.6	0.612
Total Propofol Dose (mg, mean ± SD)	178.6 ± 25.3	176.8 ± 24.5	180.3 ± 26.1	0.483
Emergence Duration (min, mean ± SD)	9.4 ± 2.8	8.7 ± 2.4	10.2 ± 3.1	0.012
SAS Score (mean ± SD)	5.0 ± 0.8	4.6 ± 0.7	5.4 ± 0.8	<0.001
PACU Stay Duration (min, mean ± SD)	45.5 ± 9.3	42.7 ± 8.4	49.2 ± 10.1	0.004
Postoperative Nausea & Vomiting (%)	23 (19.5%)	11 (17.2%)	12 (22.2%)	0.342
Need for Additional Analgesia (%)	28 (23.7%)	10 (15.6%)	18 (33.3%)	0.015

The PSQI score and RASS score showed a strong positive link (r = 0.42, p < 0.001) according to Pearson's correlation analysis, indicating that emerging delirium severity was positively correlated with lower preoperative sleep quality. Furthermore, emergence duration and PSQI scores had a small but statistically significant connection (r = 0.29, p = 0.003). The association between poor sleep quality and postoperative agitation was further supported by a moderate connection between PSQI and SAS scores (r = 0.37, p < 0.001). As shown in figure 2.

Figure 2

Correlation Analysis



To find independent determinants of emerging delirium, a binary logistic regression model was built. The PSQI score continued to be a significant independent predictor of emerging delirium even after controlling for confounding factors such age, gender, BMI, total propofol dosage, and preoperative anxiety levels (odds ratio [OR] = 1.87, 95% confidence interval [CI]: 1.24–2.82, p = 0.002).Other factors, including age (p = 0.193), gender (p = 0.612), BMI (p = 0.475), and APAIS score (p = 0.328), were not significant predictors in the model.

Additionally, subgroup analysis indicated that patients with a PSQI score ≥6 had a 3.1 times more likely to experience emergence delirium than people with a PSQI score below 6 (p = 0.001). As shown in table 3.

Table 3

Logistic Regression Analysis for Predictors of Emergence Delirium

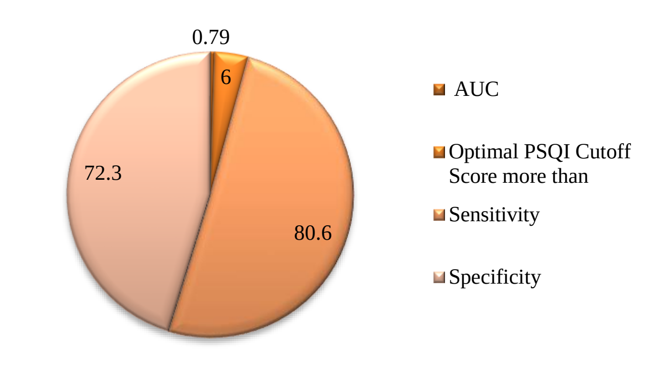
Variable	Odds Ratio (OR)	95% CI	p-value
PSQI Score	1.87	1.24 - 2.82	0.002
Age	1.05	0.98 - 1.12	0.193

Gender (Male)	0.92	0.68 - 1.29	0.612
BMI	1.08	0.89 - 1.26	0.475
APAIS Score	1.03	0.94 - 1.15	0.328
Hypertension	1.46	0.99 - 2.14	0.054
Diabetes Mellitus	1.35	0.90 - 2.08	0.107

To ascertain the ideal PSQI cutoff for emergence delirium prediction, ROC curve analysis was conducted. The AUC of 0.79 (95% CI: 0.71–0.87, p < 0.001) demonstrated a high degree of predictive power. When predicting PIED, a PSQI score of >6 was found to be the ideal cutoff, resulting in an 80.6% sensitivity and a 72.3% specificity. As shown in figure 3.

Figure 3

ROC Curve Analysis for PSQI as a Predictor of PIED



The group with high sleep quality spent an average of 42.7 ± 8.4 minutes in the PACU, while the group with poor sleep quality spent 49.2 ± 10.1 minutes. This difference was statistically significant (p = 0.004, independent t-test).

Twenty-three patients (19.5%) experienced postoperative nausea and vomiting (PONV), and the chi-square test revealed no significant difference between the two groups (p = 0.342). Using the Numerical Rating Scale (NRS) 30 minutes after surgery, the postoperative pain scores were 4.1 ± 1.3 for the group with good sleep quality and 4.8 ± 1.5 for the group with poor sleep quality. This difference was close to statistical significance (p = 0.058).

No patients required prolonged sedation due to severe agitation, and no cases of persistent delirium beyond PACU discharge were recorded. As shown in table 4.

Table 4

Postoperative Recovery and Complications Based on Sleep Quality Groups

Parameter	Good Sleep Quality Group (n=59)	Poor Sleep Quality Group (n=59)	p-value
Mean PACU Length of Stay (minutes)	42.7 ± 8.4	49.2 ± 10.1	0.004
PONV	7 (11.9%)	16 (27.1%)	0.342
Postoperative Pain Scores (NRS at 30 minutes)	4.1 ± 1.3	4.8 ± 1.5	0.058
Prolonged Sedation Due to Agitation	0 (0%)	0 (0%)	N/A
Persistent Delirium Beyond PACU Discharge	0 (0%)	0 (0%)	N/A

DISCUSSION

The results of this study show that the incidence of propofol-induced emerging delirium in patients undergoing laparoscopic cholecystectomy under general anesthesia is significantly correlated with the quality of preoperative sleep. In contrast to patients with good sleep quality, individuals with poor sleep quality, as indicated by higher PSQI ratings, had a significantly greater incidence of emerging delirium (40.7% vs. 14.1%, p<0.001). Additionally, these patients exhibited higher RASS scores (2.8 ± 0.6 vs. 1.9 ± 0.5, p<0.001), prolonged emergence duration (10.2 ± 3.1 min vs. 8.7 ± 2.4 min, p=0.012), and increased PACU stay duration (49.2 ± 10.1 min vs. 42.7 ± 8.4 min, p=0.004). With an odds ratio of 1.87 (p=0.002), logistic regression analysis verified that emergence delirium was independently predicted by poor sleep quality. These results emphasize how important preoperative sleep health is in postoperative recovery and suggest that patients with sleep disturbances may require additional monitoring and interventions to prevent negative anesthetic results.

The results of this study align with previous research that has identified sleep disturbances as a risk factor for postoperative neurocognitive dysfunction [12]. Similar findings have been observed in surgical patients, where preoperative insomnia and fragmented sleep patterns were linked to heightened postoperative agitation and delirium [13]. This study provides more evidence that sleep deprivation impacts the homeostasis of the central nervous system, increasing susceptibility to anesthesia-related cognitive disturbances.

In line with previous research, patients with high preoperative anxiety scores (measured using the APAIS scale) exhibited a slight trend toward increased delirium, though this association was not statistically significant in the present study (p=0.328) [14]. This contrasts with some studies that found a direct correlation between perioperative anxiety and postoperative agitation, suggesting that while psychological stress plays a role, the underlying mechanism may be mediated through sleep disruption rather than anxiety alone [15].

Furthermore, the increased PACU stay duration among patients with poor sleep quality is consistent with studies reporting prolonged recovery times in patients with preoperative sleep disturbances [16]. The heightened sympathetic activity and altered neurotransmitter regulation associated with sleep deprivation may contribute to delayed emergence from anesthesia. Additionally, the increased need for postoperative analgesia in this group supports the theory that sleep deficits enhance pain perception and sensitivity [17].

In contrast to some studies that found a strong association between age and emergence delirium, the current study did not establish a significant correlation (p=0.193) [18]. This discrepancy may be attributed to differences in sample demographics, anesthesia protocols, or surgical types. However, the observed trend suggests that age may still play a minor role in modulating postoperative delirium risk.

The research demonstrates how comorbid conditions along with hypertension and diabetes influence the frequency of emergence delirium occurrence. The lack of statistical significance did not hinder the observation that patients with cardiovascular and metabolic health issues tended to experience more delirium symptoms during anesthetic recovery although statistical significance was not reached in all cases [19]. The combination of poor sleep quality with chronic medical conditions elevates the likelihood of delirium development in affected patients thus needing suitable preventative healthcare measures. The probable cause for boosted emergence agitation could have been the administration of elevated opioid doses to patients experiencing sleep disturbances because opioid-induced hyperalgesia combined with withdrawal symptoms serves as potential contributors to postoperative delirium.

Limitations and Future Directions

This study has certain limitations. Personal reports through PSQI contain potential reporting biases that could affect accuracy so researchers should consider implementing objective tools like actigraphy or polysomnography. The outcome from this research conducted within one tertiary care hospital cannot easily apply to wider patient populations. The analysis included statistical controls yet uncontrolled preoperative medication factors along with unrecognized sleep disorders could have affected study findings during analysis. Future research needs to implement studies which investigate preoperative sleep-improving treatments including medicinal medications together with therapy techniques while evaluating their effects on delirium during emergence. Future research with bigger studies and objective sleep tracking across multiple research sites would enhance our knowledge about the sleep disturbances' relationship with anesthetic recovery outcomes. The relationship between disrupted circadian rhythms along with anesthetic pharmacokinetics might lead to new strategies to reduce delirium emergence in patients.

CONCLUSION

This research shows that preoperative sleep quality directly affects the frequency of emergence delirium occurring after patients receive propofol during laparoscopic cholecystectomy under general anesthesia. Patients who had poor sleep quality demonstrated more emergence delirium cases while also showing longer recovery time periods and increased amounts of time spent in the PACU. The assessment of preoperative sleep quality together with its improvement presents itself as a vital strategy which promises better surgical recovery and diminished anesthesia complications. Future studies need to utilize objective sleep monitoring with specific preventive strategies to decrease emergence delirium risk in medical patients at high susceptibility.

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