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Original Article

Efficacy of comprehensive nursing in stabilizing perioperative hemodynamic indicators and reducing complications in patients under general anesthesia

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Abstract: Objective: To evaluate the effects of a comprehensive nursing model on perioperative experiences and complications in patients undergoing general anesthesia. Methods: A retrospective analysis was conducted on 98 patients who underwent general anesthesia at the First Affiliated Hospital, Jiangxi Medical College, Nanchang University from August 2022 to March 2024. Patients were divided into a traditional group (TG, n=41) and a comprehensive nursing group (CG, n=57) based on their perioperative nursing model. Surgical data, recovery metrics, stress-related indicators before and after surgery, and perioperative hemodynamic indicators were compared between the two groups. Postoperative cognitive function and complication rates were also assessed. Results: The CG had a shorter hospital stay compared to the TG (P<0.05). On postoperative day 1, epinephrine and norepinephrine levels in the CG were lower than those in the TG (P<0.05). At T3 and T4, systolic blood pressure in the CG was lower than of the TG (P<0.05), and at T1, diastolic blood pressure was also lower in the CG (P<0.05). At T5, the heart rate in the CG was lower than of the TG (P<0.05). Awakening and extubation times were shorter in the CG than the TG (both P<0.05). On postoperative day 1, Mini-Mental State Examination scores were higher in the CG than the TG (P<0.05), while Visual Analogue Scale scores were lower (P<0.05). The total incidence of perioperative complications was 8.77% (5/57) in the CG, significantly lower than 26.83% (11/41) in the TG (P<0.05). Conclusion: Comprehensive nursing interventions can effectively reduce perioperative stress, shorten emergence and extubation times, mitigate short-term cognitive decline, and decrease perioperative complications in patients undergoing general anesthesia.

Keywords: General anesthesia surgery, comprehensive nursing model, perioperative experience, cognitive function, complication, emergence

Introduction

General anesthesia involves the administration of anesthetic agents via inhalation, intravenous, or intramuscular injection, temporarily suppressing the central nervous system to induce unconsciousness, loss of nociception, amnesia, reflex inhibition, and skeletal muscle relaxation [1, 2]. It is a common approach in surgical procedures and plays a critical role in mitigating patients' stress responses during surgery [3]. However, according to World Health Organization (WHO) data, approximately 310 million patients worldwide undergo surgical procedures annually [4], with anesthesia-related mortality rates reaching as high as 20% [5]. Studies suggest that this high mortality may be partly due to the susceptibility of anesthetized patients to negative psychological states, such as anxiety and fear, which can further destabilize the autonomic nervous system [6].

Active nursing interventions are essential for optimizing perioperative recovery in surgical patients [7]. However, traditional perioperative nursing for general anesthesia procedures often faces challenges, such as inconsistent nursing processes, insufficient analytical and reflective practices among nursing staff, fragmented monitoring of patient indicators, and a

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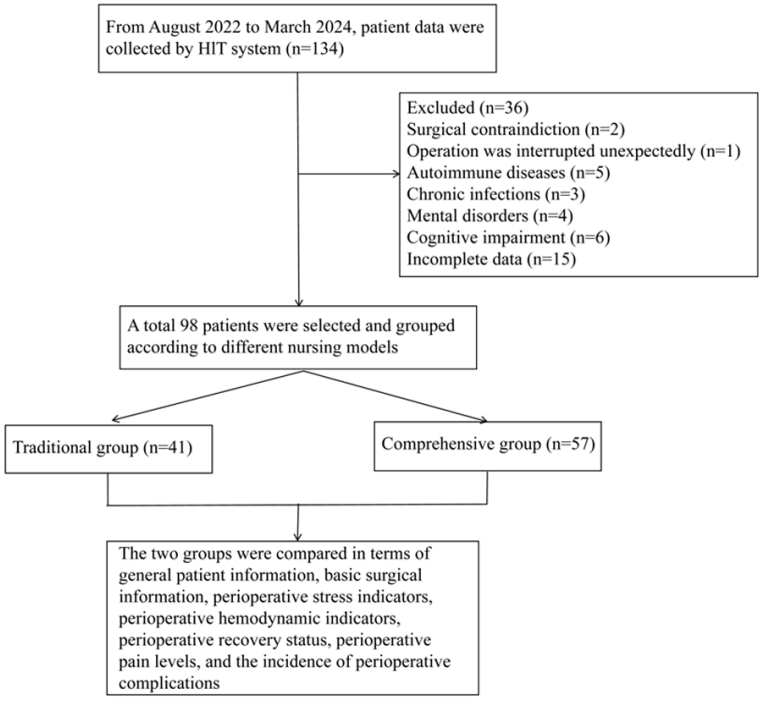

Figure 1. Flow chart of the study.

lack of dynamic responses to changing patient needs. These issues may compromise patients' recovery after general anesthesia [8, 9].

The comprehensive nursing model addresses these limitations by expanding traditional care to include multiple aspects that influence recovery, such as environmental factors, psychological support, and overall physical condition. This holistic approach can significantly improve recovery and enhance nursing effectiveness [10]. While research has demonstrated the benefits of comprehensive nursing for patients with leukemia and pulmonary infections, its effect on patients undergoing general anesthesia for abdominal surgery remains underexplored [11, 12].

This study aims to evaluate the effects of a comprehensive nursing model in mitigating perioperative stress responses in patients undergoing abdominal surgery under general anesthesia, providing evidence for its role in promoting faster postoperative recovery.

Materials and methods

Study design and patient screening

This retrospective study was approved by the Ethics Committee of the First Affiliated Hospital, Jiangxi Medical College, Nanchang University. Clinical data from patients who underwent general anesthesia for abdominal surgery from August 2022 to March 2024 were obtained from the hospital's electronic medical record system. A total of 134 patients were initially identified and screened based on inclusion and exclusion criteria. The detailed screening process is shown in **Figure 1**.

Inclusion criteria: (1) Patients aged ≥18 years. (2) Patients eligible for surgery and undergoing abdominal surgery under general anesthesia at our hospital. (3) Patients with complete records, including demographic information, surgical data, perioperative stress and hemodynamic indicators, perioperative recovery status, cognitive function assessments, and complication rates.

Exclusion criteria: (1) Patients with incomplete data. (2) Patients with surgical contraindications. (3) Patients whose surgeries were interrupted due to unexpected events. (4) Patients with autoimmune diseases. (5) Patients with chronic infections. (6) Patients with mental disorders. (7) Patients with pre-existing cognitive impairments preventing cognitive function assessments.

Perioperative cognitive function was assessed using the Mini-Mental State Examination (MMSE), with total scores ranging from 0 to 30 [13]. Scores between 27 and 30 indicate normal cognitive function, while scores below 27 indicate cognitive impairment.

Data collection

After applying the inclusion and exclusion criteria, 98 patients were included in the final analysis. These patients were divided into two groups based on the nursing model: the traditional group (TG, n=41), which received standard perioperative nursing care, and the comprehensive group (CG, n=57), which received comprehensive perioperative nursing care.

Traditional perioperative nursing: This included preoperative health education, physical assessment, pharmacologic interventions for underlying conditions, thermal comfort maintenance during surgery, administration of prophylactic antibiotics postoperatively, early ambulation encouragement, and rehabilitation guidance.

Comprehensive perioperative nursing: In addition to the traditional nursing measures, this model incorporated environmental and psychological interventions: (1) Environmental interventions: Focused on optimizing the ward, operating room, and recovery room environments. The ward environment emphasized a warm and tidy living space. The operating room interventions included preoperative warming blankets, warm water for intraoperative rinsing and fluid replenishment, and controlled temperature in the recovery room to facilitate recovery. (2) Psychological interventions: Included preoperative psychological interviews to assess mental state and provide emotional support. Postoperatively, families and friends were encouraged to offer emotional support to alleviate pain and anxiety.

The following patient data were collected using the hospital information system: (1) General information: Gender, age, body mass index (BMI), and underlying diseases. (2) Surgical data: Operative time, intraoperative blood loss, and length of hospital stay. (3) Perioperative stress indicators: Epinephrine and norepinephrine levels at admission and on the first postoperative day. (4) Perioperative hemodynamic indicators: Blood pressure and heart rate recorded at five time points: pre-anesthesia (T0), 30 minutes intraoperatively (T1), end of surgery (T2), immediately upon entering the recovery room (T3), 15 minutes after entering the recovery room (T4), and upon exiting the recovery room (T5). (5) Perioperative recovery status: Awakening time and extubation time. (6) Cognitive function: MMSE scores at admission, on postoperative day 1, and postoperative day 3. (7) Pain levels: Visual Analogue Scale (VAS) pain scores at admission, on postoperative day 1, and postoperative day 3. (8) Incidence of complications: Postoperative agitation, gastrointestinal discomfort, infection, hypoxemia, and hypothermia, monitored from the start of surgery until discharge.

Outcome measurements and statistical analysis

Patients were categorized into the CG and TG based on differences in nursing interventions. The primary outcome of this study was that patients in the CG, who received comprehensive nursing care, would experience faster perioperative rehabilitation compared to the TG, which received traditional nursing. Additionally, the CG was expected to show better perioperative stress indicators and a lower incidence of complications compared to the TG.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26.0. All measurement data were tested for normality and expressed as mean ± standard deviation. Differences between groups were assessed using an independent samples t-test. Quantitative indicators across various perioperative time points were compared using a paired t-test. Categorical data were expressed as rates and compared using the chi-square test. A *P*-value of less than 0.05 was considered significant.

Results

Comparison of baseline data between the two groups

Baseline data, including gender, age, BMI, American Society of Anesthesiologists (ASA) classification, and underlying diseases, were compared between the two groups. The results showed no significant differences in these variables (all $P>0.05$), indicating good comparability between the groups (**Table 1**).

Comparison of surgical conditions between the two groups

There were no significant differences between the two groups in terms of operative time and intraoperative blood loss (both $P>0.05$). However, the length of hospital stay in the CG was significantly shorter than of the TG ($P<0.05$) (**Table 2**).

Comparison of perioperative stress indicators between the two groups

No significant differences in epinephrine and norepinephrine levels were observed between

Table 1. Comparison of baseline data between the two groups ($\bar{x}\pm s$)/[n (%)]

General clinical data		Comprehensive group (n=57)	Traditional group (n=41)	t/χ^2	*P*
Gender	Male	32 (56.14)	23 (56.10)	1.773	0.997
	Female	25 (43.86)	18 (43.90)		
Average age (years)		53.26±12.65	52.98±13.51	0.105	0.917
Average BMI (kg/m^2)		21.36±2.15	21.98±2.81	1.237	0.219
ASA classification	Grade I	25 (43.86)	15 (36.59)	0.522	0.470
	Grade II	32 (56.14)	26 (63.41)		
Underlying diseases	Hypertension	14 (24.56)	13 (31.71)	0.610	0.435
	Diabetes	5 (8.77)	7 (17.07)	1.529	0.216

BMI: body mass index; ASA: American Society of Anesthesiologists.

Table 2. Comparison of surgical conditions between the two groups ($\bar{x}\pm s$)

Group	Number of cases	Operative time (min)	Intraoperative blood loss (mL)	Length of hospital stay (d)
Comprehensive group	57	93.39±15.18	126.64±23.49	7.31±1.45
Traditional group	41	97.03±20.75	129.93±29.60	9.48±2.96
t	-	1.003	0.613	4.798
P	-	0.318	0.541	0.000

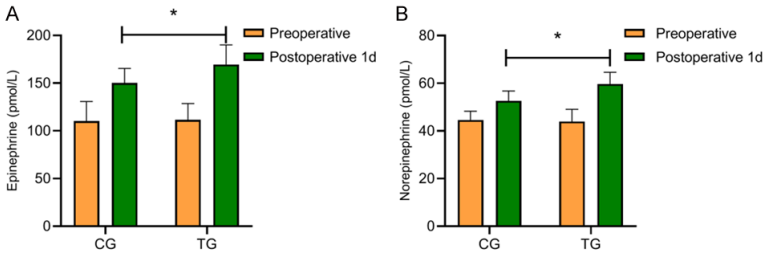

Figure 2. Comparison of perioperative stress indicators between the two groups. Preoperatively, there were no significant differences in epinephrine (A) and norepinephrine (B) levels between the two groups (*P*>0.05). On postoperative day 1, the epinephrine and norepinephrine levels in the CG were lower than those of the TG (*P*<0.05). * indicates a significant difference between groups. CG: comprehensive group; TG: traditional group.

the two groups preoperatively (both P>0.05). On postoperative day 1, both groups showed an increase in epinephrine and norepinephrine levels compared to preoperative levels (both P<0.05). Intergroup comparisons revealed that the epinephrine and norepinephrine levels in the CG were significantly lower than those of the TG on postoperative day 1 (both *P*<0.05) (**Figure 2**).

Comparison of perioperative hemodynamic indicators between the two groups

Perioperative systolic pressure, diastolic pressure, and heart rate were collected. At time points T3 and T4, systolic pressure in the CG was significantly lower than those in the TG (P=0.012, P=0.039). At T1, diastolic pressure in the CG was lower than that of the TG (P=0.009). At T5, the CG had a lower heart rate compared to the TG (P=0.016) (**Figure 3**).

Comparison of perioperative recovery status between the two groups

The awakening time and extubation time were compared between the two groups. The results showed that both the awakening time and extubation time in the CG were significantly shorter than those in the TG (*P*=0.015, *P*=0.019) (**Figure 4**).

Comparison of preoperative and postoperative cognitive function between the two groups

There were no statistically significant differences in MMSE scores between the two groups preoperatively (P>0.05). However, on postoperative day 1, the MMSE scores in the CG were significantly higher than those in the TG (*P*=0.029), while on postoperative day 3, there was no significant difference in MMSE scores between the two groups (*P*>0.05) (**Figure 5**).

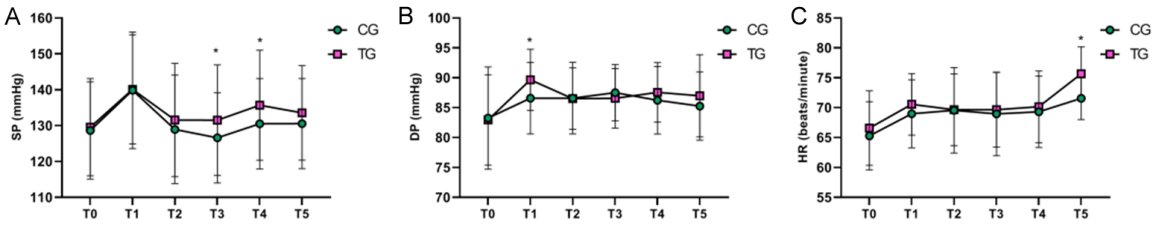

Figure 3. Comparison of perioperative systolic pressure, diastolic pressure, and heart rate between the two groups. At T3 and T4, the systolic pressure in the CG was lower than those in the TG (P<0.05) (A). At T1, diastolic pressure in the CG was lower than those in the TG (P<0.05) (B). At T5, the CG had a lower heart rate compared to the TG (P<0.05) (C). * indicates a significant difference between groups. CG: comprehensive group; TG: traditional group; SP: systolic pressure; DP: diastolic pressure; HR: heart rate.

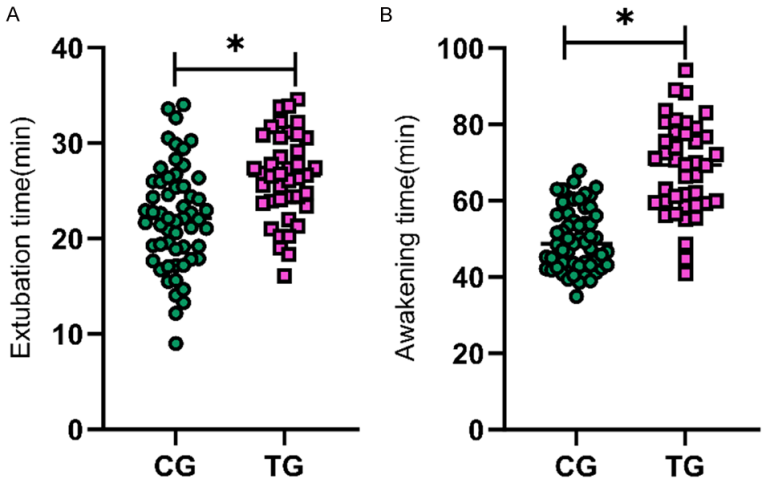

Figure 4. Comparison of perioperative recovery status between the two groups. The extubation time (A) and awakening time (B) in the CG were shorter than those of the TG (P<0.05). * indicates a significant difference between groups. CG: comprehensive group; TG: traditional group.

Discussion

The findings of this study indicate that integrating a comprehensive nursing model with traditional nursing enhances perioperative recovery in patients undergoing general anesthesia for abdominal surgery. It shortens their length of stay, awakening time, and extubation time, reduces perioperative stress, lowers serum epinephrine and norepinephrine levels, stabilizes blood pressure and heart rate, mitigates short-term postoperative cognitive decline, and decreases the occurrence of various complications.

Comparison of perioperative pain levels between the two groups

No significant differences in VAS scores were observed at admission between the two groups (P>0.05). However, on postoperative day 1 and day 3, the VAS scores in the CG were significantly lower than those in the TG (P=0.009, P=0.018) (**Figure 6**).

Comparison of follow-up complication rates between the two groups

In the follow-up, one case of postoperative agitation, three cases of gastrointestinal discomfort, and one case of infection occurred in the CG, with a total complication rate of 8.77% (5/57). This was significantly lower than the complication rate in the TG, which was 26.83% (11/41) (P<0.05) (**Figure 7**).

The results of this study align with those of other scholars in demonstrating that a comprehensive nursing model accelerates the recovery of patients undergoing general anesthesia for abdominal surgery. For example, Zhang et al. highlighted that in critically ill neurosurgical patients with tracheostomies, the 5E nursing intervention significantly reduced infection rates and improved postoperative recovery [14]. The findings of this study support related research, showing that the integration of various nursing strategies, multidimensional considerations, and a patient-centered approach, guided by modern nursing principles and meticulous procedures, improves postoperative recovery.

However, some studies present different perspectives. For instance, Hu et al. through a comprehensive analysis of mixed-method stud-

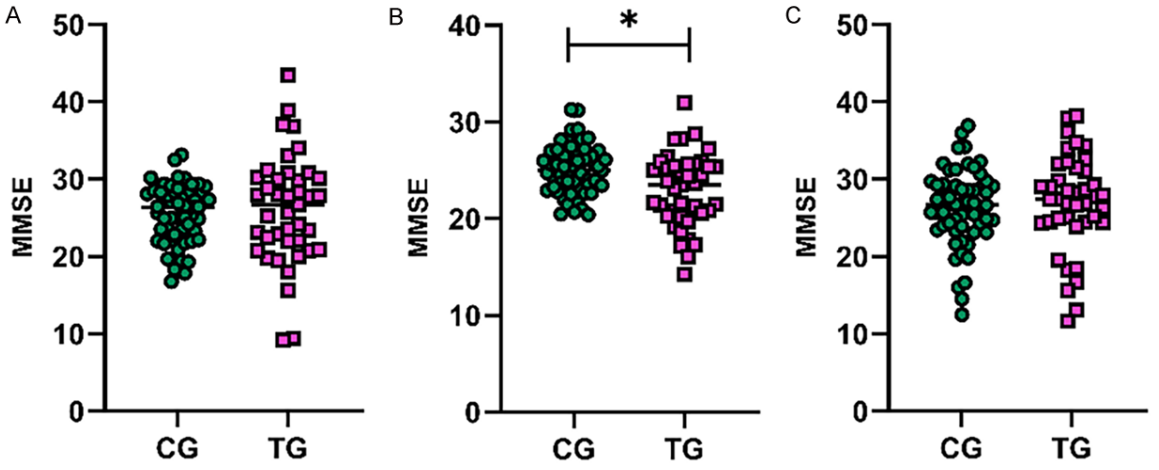

Figure 5. Comparison of preoperative and postoperative cognitive function between the two groups. There were no significant differences in MMSE scores between the two groups preoperatively (A) and on postoperative day 3 (C) (P>0.05). On postoperative day 1 (B), the MMSE scores were higher in the CG compared to the TG (P<0.05). * indicates a significant difference between groups. MMSE: Mini-Mental State Examination; CG: comprehensive group; TG: traditional group.

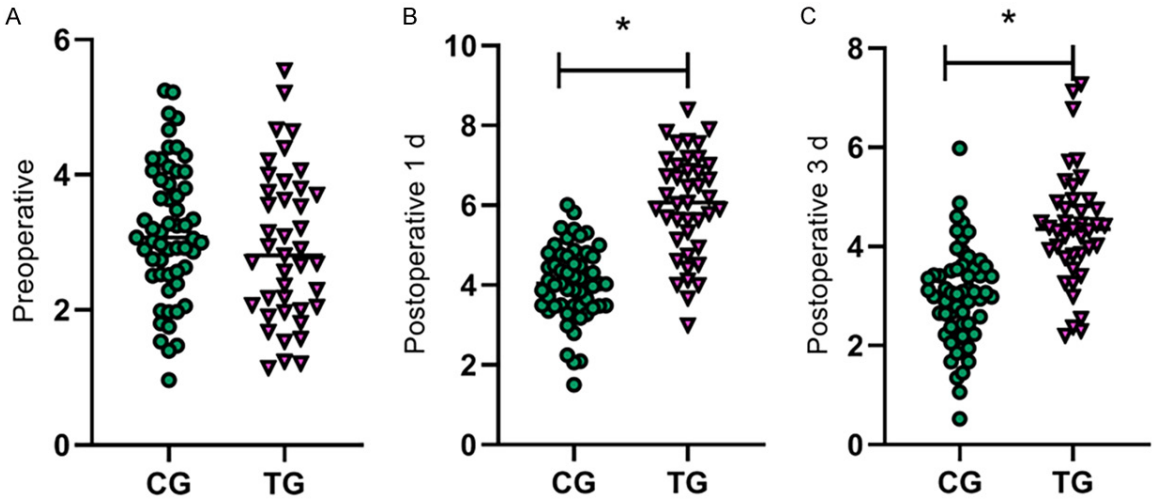

Figure 6. Comparison of perioperative pain levels between the two groups. There was no significant difference in the VAS scores at admission between the two groups (P>0.05) (A). However, on postoperative day 1 (B) and day 3 (C), the VAS scores of the CG were lower than those of the TG (P<0.05). * indicates a significant difference between groups. VAS: Visual Analogue Scale; CG: comprehensive group; TG: traditional group.

ies in nursing, suggest that more nursing interventions do not always yield better outcomes [15]. They propose a systematic approach involving the identification of potential issues, development of solutions, and implementation of personalized interventions. This approach ensures that nursing measures have clear objectives and are precisely targeted, which can help alleviate the workload on nursing staff. The authors of this study argue that the design of their research is aligned with Ni et al.'s approach, as both employ a "problem-driven method" [16]. This approach identifies potential issues affecting patients' postoperative recovery and develops feasible measures from multiple perspectives. The validity of this method has been confirmed by other studies [17].

The findings of this study show that patients receiving comprehensive perioperative nursing demonstrated superior perioperative stress indicators, representing a significant advantage over the traditional nursing group. This is a

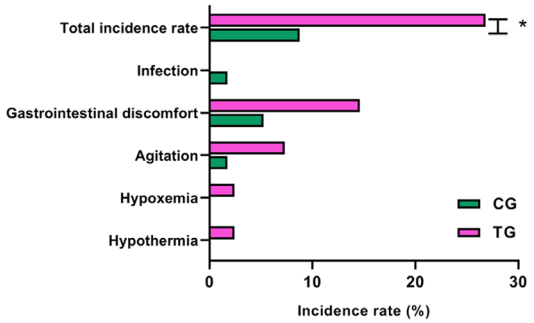

Figure 7. Comparison of follow-up complication rates between the two groups. The total incidence of complications was 8.77% (5/57) in the CG, lower than 26.83% (11/41) in the TG ($P<0.05$). * indicates a significant difference between groups. CG: comprehensive group; TG: traditional group.

key innovative aspect of the study. The authors assert that anesthesia and surgery are inherently stressful events with profound effects. This stress is unavoidable during the surgical process and directly affects surgical outcome [18]. Numerous studies have shown that intense stress responses can suppress immune function in patients [19, 20]. For patients undergoing general anesthesia for abdominal surgery, these stress responses can not only induce postoperative pain, anxiety, and fear but also impair cognitive function, leading to short-term abnormalities in consciousness, speech, and awakening, particularly in elderly patients [21, 22].

In this study, epinephrine and norepinephrine levels were selected as biomarkers to objectively assess postoperative stress responses. On the first postoperative day, epinephrine and norepinephrine levels in the CG were significantly lower than in the TG. Furthermore, the CG demonstrated lower blood pressure and heart rate at key perioperative time points compared to the TG, along with reduced pain levels on postoperative days 1 and 3. These findings confirm that the CG had a milder stress response throughout the perioperative period. This difference may be attributed to various factors, including intraoperative fluid warming, the use of thermal measures, postoperative psychological support, and effective nursing interventions [23-25]. These combined factors effectively reduced perioperative stress responses in patients under comprehensive nursing.

Furthermore, the study found that short-term postoperative cognitive function and the incidence of complications were superior in the CG compared to the TG, which aligns with findings from other studies [26]. The authors argue that comprehensive nursing measures address multiple factors, including environmental and psychological considerations, and target potential postoperative complications and factors that could induce cognitive dysfunction. This aligns with the principles of preventive nursing. Moreover, the CG exhibited weaker perioperative stress responses, contributing to a lower incidence of postoperative complications [27].

In conclusion, the application of comprehensive nursing measures for patients undergoing general anesthesia can alleviate perioperative stress, accelerate emergence from anesthesia, mitigate short-term cognitive decline, and reduce the incidence of various perioperative complications. The innovation of this study lies in its use of stress indicators to evaluate the impact of the comprehensive nursing model on perioperative rehabilitation in abdominal surgery patients under general anesthesia. The effectiveness of comprehensive nursing measures was validated by the quantifiable stress indicators, providing strong credibility to the findings. However, the study's limitations include its retrospective nature, the single sample source, and the lack of long-term follow-up, all of which will be addressed in future research.

Disclosure of conflict of interest

None.

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