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ORIGINAL RESEARCH

Impact of Evidence-Based Nursing Interventions on Recovery in Traumatic Brain Injury Patients Undergoing Hematoma Evacuation

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Objective: To analyze the application of evidence-based medicine optimized operating room nursing interventions in patients undergoing hematoma evacuation for traumatic brain injury and its impact on neurological function.

Methods: A retrospective analysis of clinical data from 186 patients with traumatic brain injury who underwent hematoma evacuation between September 2022 and February 2024 in our hospital. All patients met the complete inclusion and exclusion criteria. According to the interventions received, patients were divided into a control group (n=93, receiving conventional operating room nursing interventions) and an observation group (n=93, receiving evidence-based medicine optimized operating room nursing interventions). The surgical conditions, postoperative recovery, operating room nursing quality, incidence of nursing risk events, neurological function, daily living ability.

Results: ① Surgical and postoperative recovery conditions: The observation group had shorter surgical time, less intraoperative blood loss, fewer additions of intraoperative items, shorter ICU stay, and shorter total hospital stay compared to the control group (P<0.05). ② Operating room nursing quality: The observation group had higher scores in basic nursing, specialized nursing, disinfection management, and risk management compared to the control group (P<0.05). ③ Incidence of nursing risk events: The observation group had lower rates of vital sign fluctuations, gastric content reflux, transportation method errors, handover information errors, and complaints during nursing compared to the control group (P<0.05).

Conclusion: Compared with conventional operating room nursing interventions, evidence-based medicine optimized operating room nursing interventions can further improve nursing quality and promote recovery in patients undergoing hematoma evacuation for traumatic brain injury.

Keywords: evidence-based medicine, operating room nursing, traumatic brain injury, hematoma evacuation, neurological function, impact

Introduction

Traumatic brain injury (TBI) is a severe neurological disorder with high incidence and mortality rates worldwide, posing a significant threat to patients' safety and quality of life.[1] The treatment of TBI involves multidisciplinary interventions, among which surgery is a crucial method to improve patient outcomes. Surgical intervention can effectively reduce intracranial pressure, enhance brain tissue perfusion, and promote neurological recovery.[2] However, the success of surgical treatment depends not only on the technical proficiency of the surgical procedure but also on perioperative nursing interventions.[3] Therefore, improving the quality of operating room nursing to maximize clinical outcomes is of paramount importance.

Conventional operating room (OR) nursing interventions often follow a standardized protocol that may lack flexibility and personalization. These interventions typically involve basic preoperative education, routine monitoring during surgery, and standard postoperative care. However, they may not adequately address the specific needs and complexities

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of TBI patients, such as their psychological well-being, individual risk factors, and potential complications. This can lead to inadequate risk management and suboptimal recovery outcomes, highlighting the limitations of traditional approaches.

The limitations of conventional OR nursing interventions, such as insufficient risk assessment and a lack of personalized care, underscores the necessity for adopting evidence-based strategies. These limitations can contribute to increased postoperative complications and prolonged recovery times, emphasizing the need for improved nursing practices. In contrast, evidence-based medicine (EBM) optimized nursing interventions integrate the latest scientific evidence with clinical practice, allowing for a more tailored approach. This includes comprehensive preoperative assessments, individualized cognitive and psychological support, and meticulous intraoperative and postoperative care that accounts for the unique challenges faced by TBI patients.

In this context, the introduction of EBM offers a new perspective for enhancing operating room nursing.[4] EBM emphasizes integrating the latest scientific evidence with clinical practice, involving systematic evaluation, formulation, and implementation of interventions to improve patient outcomes and quality of life.[5,6] For these reasons, this study aimed to explore the application effects of evidence-based medicine optimized operating room nursing interventions in patients undergoing hematoma evacuation for TBI, and to compare these effects with conventional operating room nursing interventions, in order to provide more scientific and effective nursing strategies for clinical practice.

Materials and Methods

Basic Information

A retrospective analysis of clinical data of 186 patients undergoing hematoma evacuation for traumatic brain injury (TBI) treated at our hospital from September 2022 to February 2024 was conducted. Inclusion criteria: ① Patients with traumatic brain injury (open) were included; ② Patients underwent hematoma evacuation surgery at our hospital; ③ Patients aged ≥18 and <60 years, of any gender; ④ Patients with stable vital signs; ⑤ Clinical data of patients were complete and authentic for analysis. Exclusion criteria: ① Patients who discontinued, abandoned treatment, or died due to changes in their condition during treatment; ② Patients with other organic diseases or organ dysfunction; ③ Patients with severe infection; ④ Patients with severe consciousness disorders or mental disorders; ⑤ Mechanical ventilation time >3 days after admission; ⑥ Patients with cerebrospinal fluid leakage; ⑦ Patients with allergic reactions or relevant contraindications to the drugs or methods used in this study. Patients were divided into control group (n=93) and observation group (n=93) based on the interventions received. The baseline data of the two groups were comparable (P>0.05), as shown in Table 1. This study was approved by the Affiliated Hospital of Qingdao Binhai University Medical Ethics Committee. Informed consent was obtained from all study participants. All the methods were carried out in accordance with the Declaration of Helsinki.

Table 1 Basic Information ($\bar{x} \pm s$, n[%])

	Control (n=93)	Observation (n=93)	t/x^2	P
Gender	–	–	0.543	0.460
Male	49 (52.69)	54 (58.06)	–	–
Female	44 (47.31)	39 (41.94)	–	–
Age (years)	42.74±6.78	43.41±6.27	0.699	0.485
BMI (kg/m²)	23.65±1.42	23.71±1.26	0.304	0.760
Onset to Admission Time (h)	7.87±1.29	8.05±1.12	1.016	0.310
Education Level	–	–	0.984	0.321
High School and Below	71 (76.34)	65 (69.89)	–	–
College and Above	22 (23.66)	28 (30.11)	–	–

Methods

Control Group

The control group received routine operating room nursing interventions as follows: Preoperatively, patients or their families were briefed on the disease and surgery-related information, assisted in completing necessary examinations promptly to ensure smooth surgery, and the surgical site was shaved using a razor. Intraoperatively, appropriate nursing measures were taken as needed, such as rational use of medications, strict adherence to aseptic techniques, and warming intravenous fluids to maintain patient temperature, ensuring safe surgery. Postoperatively, necessary encouragement was given to patients upon awakening, and they were transferred back to the ward with proper handover to ward nursing staff.

Observation Group

The observation group received operating room nursing interventions optimized based on evidence-based medicine, as follows: (1) Evidence-based process: The operating room nursing team reviewed relevant literature on cranial surgery prevention and control, retrospectively analyzed the nursing methods of the control group using brainstorming, combined with research findings, clinical experience of nursing staff, and specific patient conditions for risk assessment and continuous improvement. At the same time, senior physicians specializing in cranial injury treatment and professional nursing leaders were invited for on-site guidance to jointly develop nursing protocols for cranial injury. (2) Preoperative nursing: ① Cognitive intervention: Various methods of cognitive intervention were flexibly employed based on the patient's and their family's comprehension ability to ensure the correct understanding of disease-related knowledge. Additionally, patients and their families were extensively informed about the risk factors and hazards of postoperative complications and guided to take necessary protective measures. ② Psychological care: Nursing staff emphasized communication with patients, assisting them in adjusting negative emotions, and advising them to maintain a positive attitude towards treatment. ③ Condition assessment: A comprehensive preoperative assessment of the patient's condition was conducted, including a detailed understanding of their medical history and drug allergies, identification of potential risk factors, and implementation of corresponding preventive measures. ④ Surgical preparation: Operating room nursing staff actively communicated with surgeons, grasped the surgical procedures and precautions, and ensured support for intraoperative coordination. The shaving method used in the control group was changed to clipping to avoid skin damage. Contact with the ward was made in advance to confirm the types of prophylactic medications to be used and prepare additional doses of medications that may be needed during the procedure, strictly controlling the timing of medication administration. ⑤ Operating room preparation: 30 minutes before the start of surgery, the temperature and humidity of the operating room were adjusted to the appropriate range. (3) Intraoperative Nursing: ① Thermal Care: Thermal equipment such as warming blankets were used to ensure the patient's body temperature remained within the normal range during surgery, preventing the occurrence of hypothermia-related complications. ② Infection Control: The previous single-person operation mode was changed to a collaborative two-person mode, with anesthesia nurses assisting anesthesiologists in strictly following measures to prevent ventilator-associated pneumonia and performing endotracheal intubation under general anesthesia. Catheter retention assessments were conducted to reduce unnecessary catheter use and minimize the risk of infection. The disinfection process of the fiberoptic bronchoscope was optimized by centralizing all fiberoptic bronchoscopes for unified disinfection and sterilization at the endoscopy center, and organizing relevant personnel to participate in standardized operation training before surgery. ③ Precision Management: Operating room nurses strictly adhered to aseptic operation standards, closely cooperating with surgeons in various surgical procedures, including anesthesia and positioning. Full-coverage sterile protection covers for microscopes were used to completely isolate the microscope from the surgical area, ensuring a sterile barrier. Operating room nursing staff should regularly check whether the surgeon's sterile gloves are damaged. Surgeons must change sterile gloves again before closing the surgical gap to avoid glove damage during the use of cranial drills or gravity operations leading to infection. Nurses should assist the surgeon in cleaning the area around the surgical site, promptly deal with blood stains on instruments, and replace contaminated items during surgery to prevent infection. (4) Postoperative Nursing: ① Recovery Period Monitoring: Anesthesia nurses and anesthesiologists jointly took care of patients during the anesthesia recovery period, adjusting the temperature and humidity of the recovery room to appropriate levels. Strengthening sterile management of the respiratory tract, strictly adhering to aseptic procedures for suctioning to prevent infection. At the same time,

attention was paid to protecting drainage tubes and infusion tubes to prevent blockage due to folding or slipping. ② Precautions: When the patient regained consciousness, they were promptly informed that the surgery had been successfully completed, and soothing music was played to relieve their anxiety. Detailed instructions were given to the patient and their family regarding postoperative precautions, such as wound care, infection prevention, and avoiding vigorous activities. ③ Handover of Nursing Work: Once the patient was fully awake, they were transferred back to the ward, and a detailed handover was conducted with ward nursing staff, including intraoperative conditions, postoperative care focus, and precautions, ensuring that ward nurses fully understood the patient's postoperative care requirements, ensuring continuity and consistency of nursing care.

Observation Indicators

Surgical Conditions

Including operation time, intraoperative blood loss, and number of intraoperative item additions. The above indicators were uniformly recorded by relevant medical staff in our hospital.

Postoperative Recovery

Including ICU length of stay and total length of hospital stay. The above indicators were uniformly recorded by relevant medical staff in our hospital.

Level of Operating Room Nursing Quality

According to the literature,[7] a scale for evaluating the quality of operating room nursing was designed. The assessment content includes four dimensions: basic nursing, specialized nursing, disinfection management, and risk management. Each dimension is scored from 0 to 100 points, with higher scores indicating better nursing quality.

Occurrence of Nursing Risk Events

Including fluctuations in vital signs, gastric reflux, errors in transportation methods, errors in handover information, and complaints during nursing. The above indicators were uniformly recorded by relevant medical staff in our hospital.

Neurological Function

The neurological function of patients was assessed using the National Institutes of Health Stroke Scale (NIHSS)[8] at admission and discharge. The scale scores range from 0 to 42 points, with lower scores indicating better neurological function.

Activities of Daily Living

The activities of daily living of patients were assessed using the Activities of Daily Living (ADL) scale[9] at admission and discharge. The scale scores range from 0 to 100 points, with higher scores indicating better daily living abilities.

Occurrence of Complications

Including infections, seizures, hydrocephalus, cranial defects, and lower extremity venous thrombosis. The occurrence of the above complications was uniformly recorded by relevant medical staff in our hospital.

Statistical Analysis

GraphPad Prism 8 software was used for plotting, and SPSS 22.0 was used for data analysis. Measurement data were described using ($\overline{x} \pm s$), analyzed by *t*-test; count data were described using n (%), analyzed by chi-square test. A P value < 0.05 indicated statistical significance.

Results

Comparison of Surgical and Postoperative Recovery Conditions

The observation group showed significantly lower operation time, intraoperative blood loss, number of intraoperative item additions, ICU length of stay, and total length of hospital stay compared to the control group ($P < 0.05$), as shown in Table 2.

Table 2 Comparison of Surgical and Postoperative Recovery Conditions ($\bar{x} \pm s$)

	Control (n=93)	Observation (n=93)	t	P
Operation Time (min)	81.58±10.45	74.92±10.03	4.434	<0.001
Intraoperative Blood Loss (mL)	134.97±15.69	121.76±10.91	6.666	<0.001
Number of Intraoperative Item Additions	3.52±0.78	2.14±0.57	13.775	<0.001
ICU Length of Stay (days)	7.95±1.67	6.59±1.24	6.305	<0.001
Total Length of Hospital Stay (days)	20.32±3.63	16.79±2.57	7.653	<0.001

Comparison of Surgical Ward Nursing Quality

As shown in Figure 1, the observation group exhibited significantly higher scores in basic nursing, specialized nursing, disinfection management, and risk management compared to the control group ($P < 0.05$).

Comparison of Nursing Risk Events

The observation group demonstrated significantly lower rates of abnormal fluctuations in vital signs, gastric reflux, incorrect transportation methods, incorrect handover information, and complaints during nursing compared to the control group ($P < 0.05$), as shown in Table 3.

Comparison of Neurological Function and Activities of Daily Living

As shown in Figure 2, the NIHSS scores of both groups decreased, and ADL scores increased upon discharge compared to admission, with the observation group showing a greater magnitude of change ($P < 0.05$).

Comparison of Complication Incidence

The observation group (10.75%) had a lower complication incidence compared to the control group (29.03%) ($P < 0.05$), as shown in Table 4.

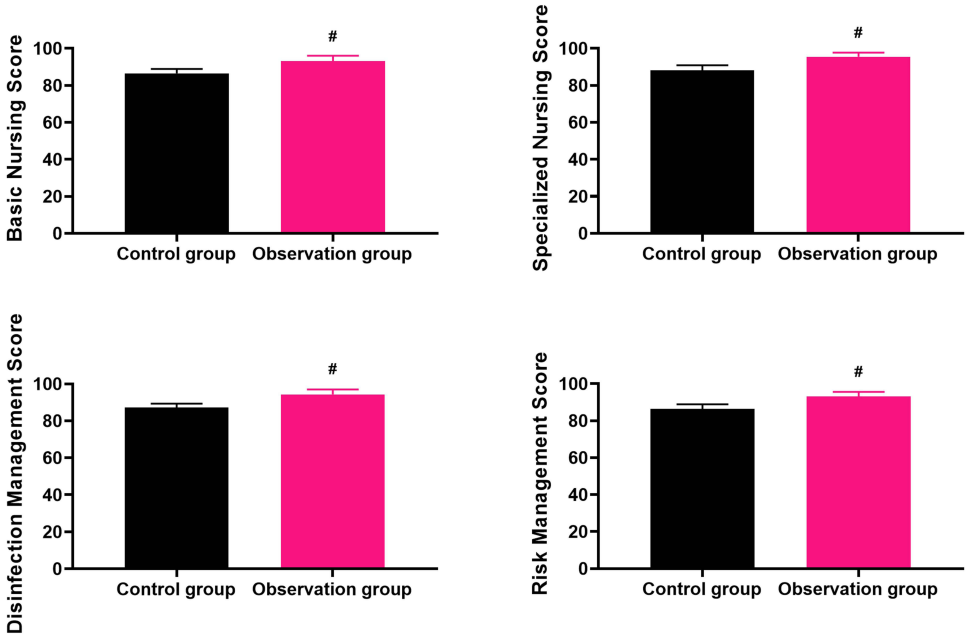

Figure 1 Comparison of Surgical Ward Nursing Quality ($\bar{x} \pm s$).
Note: Inter-group comparison, $^{\#}P < 0.05$.

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Table 3 Comparison of Nursing Risk Events [n(%)]

Nursing Risk Events	Control (n=93)	Observation (n=93)	x^2	P
Abnormal Vital Sign Fluctuations	10 (10.75)	2 (2.15)	5.701	0.017
Gastric Reflux	12 (12.90)	3 (3.23)	5.873	0.015
Incorrect Transportation	10 (10.75)	2 (2.15)	5.701	0.017
Incorrect Handover Information	11 (11.83)	2 (2.15)	6.699	0.009
Complaints during Nursing	13 (13.98)	3 (3.23)	6.838	0.008

Discussion

Traumatic brain injury (TBI) is a common and serious neurological disorder, often caused by external forces such as traffic accidents, falls, violence, and sports injuries, with relatively high incidence and mortality rates.[10] According to statistics,[11] millions of new cases of TBI are reported globally each year, and many patients require surgical treatment due to the formation of intracranial hematomas. Hematoma evacuation surgery is a key intervention for treating intracranial hematomas, aimed at removing hematomas surgically to reduce intracranial pressure and restore normal brain function.[12] However, the success of surgery depends not only on surgical expertise but also on high-quality postoperative nursing interventions to ensure patients' smooth recovery. The traditional surgical nursing model has certain limitations in the treatment of TBI patients, characterized by inadequate and unscientific nursing measures, lack of personalized care, insufficient risk assessment and management, which may lead to increased postoperative complications, prolonged recovery time, and even affect long-term prognosis of patients.[13,14] Therefore, optimizing the surgical nursing model and improving the quality of nursing care are crucial for improving the postoperative recovery outcomes of TBI patients. Evidence-based medicine is a medical model that combines the latest and best scientific evidence with clinical practice. It emphasizes the systematic acquisition, evaluation, and application of the most reliable research evidence to develop and implement scientific clinical decisions.[15] Introducing the concept of evidence-based medicine into surgical nursing helps improve the scientificity and effectiveness of nursing measures, providing personalized nursing plans, thereby enhancing treatment outcomes and quality of life for patients.[16] In recent years, the application of evidence-based nursing in surgical nursing has gradually increased, with studies[17,18] showing significant improvements in nursing quality, reduction of postoperative complications, and promotion of patient recovery. However, research on evidence-based nursing for TBI patients is still relatively limited, and specific application effects and optimal practice plans need further exploration and validation.

This study analyzed the application effect of evidence-based medicine optimized surgical nursing interventions in patients undergoing surgical treatment for traumatic brain injury (TBI). The results showed that the incidence of complications in the observation group was lower than that in the control group ($P < 0.05$); the observation group had lower rates of abnormal vital signs fluctuations, gastric reflux, transportation errors, handover information errors, and

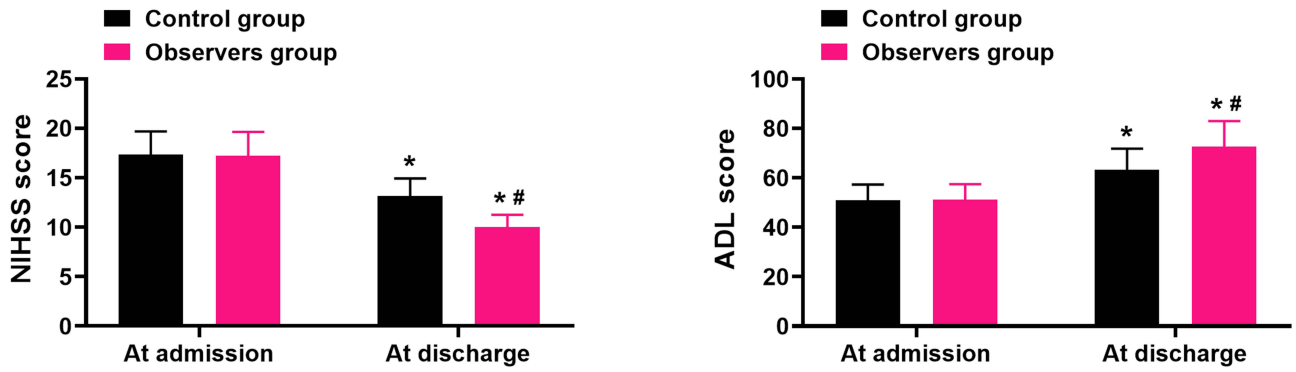

Figure 2 Comparison of Neurological Function and Activities of Daily Living ($\bar{x} \pm s$).
Notes: Compared to admission, *P < 0.05; Inter-group comparison, #P < 0.05.

Table 4 Comparison of Complication Incidence [n (%)]

Complication	Control (n=93)	Observation (n=93)	x^2	P
Infection	15 (16.13)	5 (5.38)	–	–
Epilepsy	3 (3.23)	1 (1.08)	–	–
Brain Edema	4 (4.30)	2 (2.15)	–	–
Skull Defect	2 (2.15)	0 (0.00)	–	–
Lower Extremity Venous Thrombosis	3 (3.23)	2 (2.15)	–	–
Total Incidence	27 (29.03)	10 (10.75)	9.750	0.001

complaints during nursing compared to the control group ($P < 0.05$). This result shares similarities with previous related studies,[19,20] suggesting that evidence-based medicine optimized surgical nursing has a positive role in reducing patient complications and the occurrence of nursing risk events. The reason for this is that evidence-based medicine optimized surgical nursing further strengthens the management of surgical nursing details based on evidence, incorporates relevant risk factors affecting patient complications and nursing risk events into nursing work, maximally mitigating the impact of these risk factors, thereby helping to prevent and reduce postoperative complications and nursing-related risk events in patients. Regarding surgical conditions and postoperative recovery, the results of this study showed that the observation group had lower surgical time, intraoperative blood loss, number of intraoperative item replenishments, ICU stay time, and total hospital stay time compared to the control group ($P < 0.05$); the NIHSS score at discharge in the observation group was lower, and the ADL score was higher compared to the control group ($P < 0.05$). These results suggest that evidence-based medicine optimized surgical nursing also has ideal effects in reducing surgical time, trauma, and promoting patient postoperative recovery. The reason for this is that the occurrence of postoperative complications and nursing-related risk events are important factors affecting patient recovery and prolonging patient hospital stay. When these influencing factors are effectively controlled, the patient's recovery process will also accelerate. In terms of nursing quality, the results of this study showed that the observation group had higher scores in basic nursing, specialized nursing, disinfection management, and risk management compared to the control group ($P < 0.05$), indicating that evidence-based medicine optimized surgical nursing can significantly improve the quality of surgical nursing. The reason for this is that evidence-based medicine optimized surgical nursing not only ensures the standardized use of drugs and aseptic management during surgery but also refines nursing measures related to preoperative, intraoperative, and post-operative care, especially strengthening the management of various risk points for complication prevention. This ensures the safe and smooth implementation of surgery, thereby promoting the improvement of surgical nursing quality.

The findings of this study highlight significant improvements in surgical conditions, a reduction in complications, and enhanced recovery times associated with evidence-based nursing interventions. Specifically, the evidence suggests that these optimized approaches markedly enhance surgical conditions compared to conventional operating room (OR) nursing practices, which often adhere to standardized protocols that may not adequately address the unique needs of each patient. Unlike conventional methods, evidence-based practices allow for a more flexible and tailored approach, incorporating the latest scientific evidence to effectively manage specific patient conditions. This adaptability contributes to improved surgical outcomes by ensuring that interventions are both relevant and responsive to the individual circumstances of each patient. Additionally, the study reveals a notable decrease in complications linked to the use of optimized nursing interventions. Conventional practices often fail to fully address the complexities inherent in patient care, potentially overlooking critical factors that contribute to complications. In contrast, evidence-based nursing emphasizes comprehensive assessments and proactive management strategies. This holistic approach not only mitigates risks but also enhances patient safety by ensuring that all aspects of care are considered and addressed. Moreover, patients undergoing hematoma evacuation demonstrate faster recovery times with the implementation of optimized nursing interventions. Conventional OR nursing practices may lack the necessary adaptability for rapid recovery protocols, often resulting in extended hospital stays and longer recovery periods. Evidence-based methods, however, prioritize swift mobilization and tailored pain management strategies, both of which are proven to accelerate recovery and improve overall patient satisfaction. Collectively, these findings underscore the limitations of conventional nursing

practices, which often do not integrate new evidence or adapt to the specific needs of patients. The study's results advocate for a necessary shift towards evidence-based nursing interventions, not only to enhance individual patient outcomes but also to address the broader challenges faced in traditional nursing approaches. The mechanisms underlying these positive outcomes can be attributed to the integration of current research findings into clinical practice, the emphasis on individualized care, and the proactive nature of evidence-based strategies, all of which contribute to improved surgical conditions, reduced complications, and enhanced recovery in patients.

In summary, the application effect of evidence-based medicine optimized surgical nursing interventions in patients undergoing hematoma evacuation for traumatic brain injury is ideal. Compared to conventional surgical nursing interventions, it can further improve nursing quality, promote patient surgical recovery, alleviate patient neurological deficits, improve patient daily life abilities, and reduce the risk of related complications. However, it is important to note that this study still has some limitations that need to be addressed. Firstly, the sample size of this study is relatively small, which may affect the credibility and applicability of the results and also limit the statistical significance of certain results. Secondly, this study adopted a retrospective analysis, which may introduce information bias and treatment selection bias. Additionally, this study was conducted in only one hospital, which may limit the external validity of the research findings. Lastly, this study did not fully consider individual differences among patients, such as lifestyle and basic health status, which could impact the effectiveness of the intervention. Therefore, in future research, we will increase the sample size, improve the study design, and pay more attention to potential influencing factors to enhance the credibility and comprehensiveness of the research.

Disclosure

The authors report no conflicts of interest in this work.

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