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ORIGINAL RESEARCH

Improving Patient Outcomes in mTBI: The Role of Integrated Nursing Interventions in the Emergency Department

Ting Feng, Peng Zhao, Jiao Wang, Xiaoye Du, Meimei Ai, Jing Yang, Junjie Li

Department of Emergency, Xijing Hospital, Air Force Medical University, Xi'an, Shaanxi, 710032, People's Republic of China

Correspondence: Ting Feng, Department of Emergency, Xijing Hospital, Air Force Medical University, Xi'an, Shaanxi, 710032, People's Republic of China, Email fengtingff24@163.com

Background: Traumatic brain injury (TBI) is a major cause of morbidity and mortality, often requiring emergency department (ED) management. Integrated Nursing Interventions play a critical role in the care of TBI patients, but limited research has evaluated their efficacy in this setting. This study aims to assess the impact of Integrated Nursing Interventions on patient outcomes and complications in the ED.

Methods: This retrospective study included 246 patients with mild traumatic brain injury (mTBI) treated in the emergency department from January 2022 to December 2022. Of these, 138 patients received Integrated Nursing Interventions, while 108 did not. Baseline characteristics, clinical outcomes, and complications were compared between the two groups. Descriptive statistics, logistic regression, and receiver operating characteristic (ROC) curve analysis were used to evaluate the effect of nursing interventions on outcomes such as mortality, complications, and hospital stay.

Results: Among the 246 mTBI patients, those receiving Integrated Nursing Interventions (n=138, 56.1%) experienced significantly lower rates of adverse events, including perioperative intracranial hemorrhage (4.3% vs 12.0%, P=0.025) and shorter hospital stays (6 ±2 days vs 11±3 days, P<0.001). The study sample included 56.5% female, with 80.1% age ≤ 80. Integrated Nursing Interventions refer to coordinated care strategies that combine multiple nursing approaches tailored to address both physical and psychological needs of patients. For instance, the use of patient education combined with individualized pain management strategies. Logistic regression analysis revealed that Integrated Nursing Interventions were associated with a significant reduction in in-hospital mortality (OR=1.828, 95% CI: 1.619–2.318, P<0.001). ROC curve analysis demonstrated strong predictive accuracy for outcomes such as readmission rate (AUC=0.757), 30-day mortality (AUC=0.836), and 90-day mortality (AUC=0.760).

Conclusion: Integrated Nursing Interventions in the emergency department significantly improve patient outcomes for mTBI patients, reducing mortality, complications, and length of hospital stay. These interventions, which include early assessment, timely intervention, patient education, and collaborative care, are essential for optimizing TBI management. The high predictive value of these interventions further underscores their importance in emergency care. Future research should focus on the long-term effects of Integrated Nursing Interventions on patient outcomes across different age groups, particularly in chronic disease management. Further studies could explore the role of digital health tools in enhancing integrated care.

Keywords: traumatic brain injury, emergency department, nursing interventions, prognosis, patient management

Introduction

Mild traumatic brain injury (mTBI) represents a significant public health challenge, accounting for over 80–90% of all traumatic brain injury (TBI) cases worldwide.[1–3] Although mTBI is often perceived as less severe compared to other forms of brain injury, it remains a leading cause of both short-term and long-term disability, particularly among young adults.[4] Patients with mTBI frequently experience persistent physical, cognitive, and emotional impairments, which can significantly impact their quality of life.[5] The critical role of emergency department (ED) care in the management of

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mTBI patients has been well-documented, with evidence suggesting that early intervention and rapid treatment are essential in improving patient outcomes.[6]

Upon arrival at the ED, mTBI patients require immediate and effective assessment, stabilization, and treatment to maximize their chances of recovery and reduce the risk of adverse events.[7,8] Nurses are integral to the management of mTBI within the ED, bearing significant responsibilities that span the entirety of the patient's hospitalization. Their involvement extends beyond initial care to include ongoing monitoring, coordination of interdisciplinary care, and ensuring timely and appropriate follow-up. Stocker and other researchers believe that traumatic brain injury (TBI) requires treatment in the intensive care unit, where a multidisciplinary team of medical professionals works closely together. This team includes intensivists, neurosurgeons, neurologists, as well as ICU nurses, physical therapists, and brain rehabilitation therapists.[9] Previous studies on mild traumatic brain injury (mTBI) highlight the importance of early and effective nursing interventions in the emergency department, where timely management can significantly influence patient outcomes.[10] Despite the growing recognition of mTBI in the ED, current nursing protocols for its management remain inconsistent, with a notable gap in standardized care strategies. This study seeks to address these gaps by evaluating the impact of integrated nursing interventions on patient outcomes.The importance of our research is rooted in addressing the urgent need for efficient and effective care during the initial stages of mTBI presentation in the ED. Given that mTBI constitutes the majority of TBI cases, the absence of comprehensive nursing interventions could lead to suboptimal patient outcomes, an increased likelihood of adverse events, and prolonged recovery trajectories. By highlighting the essential role of nursing interventions, this study aims to contribute to the refinement of mTBI care protocols, particularly in the context of the ED.[5,11]

Comprehensive care, as provided by nurses, is not confined to the emergency setting alone. It encompasses a holistic approach that includes continuous communication, educational support, and various interventions designed to aid in the rehabilitation of mTBI patients. This approach targets multiple aspects of recovery, including cognitive, motor, and language function, thus promoting a more complete and sustained recovery process. For example, Zarshenas explored cognitive and motor recovery in TBI patients and the predictors of long-term outcomes, highlighting the impact of the timing of inpatient rehabilitation (IR) on cognitive and motor recovery.[12] The study also emphasized the importance of informing patients and their families about the residual health conditions post-IR discharge. Additionally, Horn et al conducted a longitudinal study involving over 2130 TBI patients and found that the effort expended during treatment, the time spent on more complex therapeutic activities, and the use of specific medications were associated with better outcomes.[13]

This study aims to evaluate the effectiveness of integrated nursing interventions in the management of mTBI in the emergency department (ED). It also seeks to identify and address gaps in current nursing protocols specific to mTBI care. While evidence supports the effectiveness of nursing interventions in TBI care, further research is needed to optimize their application in the ED, especially for mTBI patients. Few studies have focused specifically on the impact of these interventions in the ED, and there is a lack of standardized protocols for their implementation. Therefore, this study will evaluate integrated nursing interventions, such as pain management and patient education, tailored to mTBI patients in the ED, and aim to provide insights into the most effective strategies for their implementation.

Materials and Methods

Patient Selection Study Design and Participants

This retrospective cohort study was designed to assess the impact of integrated emergency nursing interventions on the outcomes of patients with mild traumatic brain injury (mTBI) in the emergency department (ED). The study included adult patients (18 years or older) who presented to the ED with a diagnosis of mTBI between January 2022 and December 2022 and required hospitalization. The definition of mild traumatic brain injury (mTBI) used in this study follows the criteria outlined by the American Congress of Rehabilitation Medicine (ACRM), which defines mTBI as a trauma-induced alteration in mental status, with a Glasgow Coma Scale (GCS) score of 13–15 and a loss of consciousness of less than 30 minutes,[14] and including conditions such as concussion, minor brain contusion, and small-volume traumatic intracranial hemorrhage. Diagnosis was confirmed by two independent imaging specialists who reviewed brain CT and MRI scans. The inclusion criteria were: (1) patients aged 18 years or older; (2) a confirmed

diagnosis of mTBI based on imaging and clinical evaluation; and (3) no other significant comorbidities. Exclusion criteria included: (1) incomplete clinical data; or (2) death within 24 hours of admission. The study was approved by the Ethics Committee of Xijing Hospital, and was conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from all participants.

Integrated Emergency Nursing Interventions

For the No-integrated emergency nursing interventions group (ie, the control group), standard care practices commonly implemented in the clinical setting were provided. These practices included regular follow-ups via phone calls to address patient inquiries, monitor any abnormalities, and provide timely medical intervention when necessary. Additionally, the control group received routine assessments and treatments aligned with the standard clinical protocols for mTBI management. Key components of the standard care provided to both groups included pain assessment, basic pain management techniques, fundamental skin and wound care, medication management, monitoring, and follow-up.

While these elements were part of the routine care provided to both groups, the intervention group also received additional customized nursing interventions designed to comprehensively address the diverse needs of the patients. Integrated emergency nursing interventions refer to a holistic approach that encompasses all aspects of patient well-being, including physical, psychological, social, and emotional needs. This approach involves personalized and comprehensive interventions aimed at promoting optimal health outcomes and enhancing the patient's quality of life.

The following integrated nursing interventions were included in the study protocol: pain management strategies, patient education, memory training, and motor function training. These interventions were selected based on existing evidence supporting their effectiveness in improving patient outcomes for mTBI.[15] To ensure precision in the implementation of nursing interventions, the frequency, duration, and specific methods were standardized:

Patient Education: Patient education was conducted in accordance with the guidelines set by the National Institute for Health and Care Excellence (NICE), which recommend that patients with mTBI receive information on managing symptoms, returning to daily activities, and recognizing potential complications.[16] Patients and their families were provided with educational resources, including the "Traumatic Brain Injury Guidebook" and a "Cognitive Rehabilitation Instruction Manual", aligned with established guidelines. Educational sessions were held twice weekly, each lasting 45 minutes, with content tailored to the patient's individual needs.

Language Training: Patients engaged in structured language training, including scheduled conversations with nursing staff three times a week for 30 minutes per session. Non-verbal communication techniques were taught, and patients participated in role-playing and scenario-based discussions to enhance communication skills.

Memory Training: Memory training was included based on its established efficacy in improving cognitive outcomes for mTBI patients. A variety of cognitive tasks were utilized, including memory recall games such as word-list recall, which has been shown to enhance cognitive recovery in mTBI patients.[17] A structured memory training program was implemented, involving activities such as reading newspapers for 20 minutes daily, listening to the radio and music twice a week for 30 minutes, and participating in stimulating games for 45 minutes, three times a week.

Motor Function Training: Motor function training was incorporated due to its documented benefits in improving physical rehabilitation for mTBI patients. Exercises aimed at improving balance and coordination were included, following protocols demonstrated to improve functional outcomes in mTBI rehabilitation.[18] To prevent complications, motor function training began within 48 hours of admission, involving active and passive movements of the affected limbs. The training sessions occurred three times a day, each lasting 20 minutes, with a gradual increase in intensity. Additional therapies included massage twice weekly, hot compresses every other day, and acupuncture once a week.

It is important to note that specialized nursing interventions are intended to assist and support the medical team's treatment plan. These interventions are not designed to replace medical care but rather to work in coordination with the physicians' treatment, aiming to comprehensively enhance the quality of patient care and treatment outcomes. Both specialized and non-specialized nursing interventions are provided by general nurses.

Data Collection and Outcome Measures

Data were collected retrospectively from electronic medical records. To ensure data accuracy, all collected data was double-checked by two independent researchers. Any discrepancies identified during the verification process were resolved through discussion with the research team to ensure consistency and reliability. Primary outcomes included the incidence of perioperative complications, complications across various physiological systems, and the length of hospital stay. A comprehensive survey of physiological complications was conducted in the second week post-admission to evaluate the short-term impact of the nursing interventions. Secondary outcomes included rates of readmission, 30-day mortality, and 90-day mortality.

Circulatory System: The evaluation included monitoring blood pressure, heart rate, and any cardiovascular events; Urinary System: Parameters such as urine output, kidney function, and the occurrence of urinary tract infections were assessed; Digestive System: The analysis focused on complications like gastrointestinal bleeding, bowel function, and nutritional status; Coagulation System: The study examined complications related to coagulation, including clotting factors and thrombotic events.

Data Analysis

Descriptive statistics were used to summarize patient characteristics and outcomes. The incidence of adverse events and other binary outcomes was compared using chi-square or Fisher's exact tests, while continuous outcomes, such as hospital stay duration, were analyzed using *t*-tests or non-parametric methods as appropriate. Multivariable regression analysis was performed to control for potential confounding factors such as age, gender, injury severity, and comorbidities. Statistical analyses were conducted using SPSS 25.0 (IBM, Armonk, NY, USA), with $P<0.05$ considered statistically significant. Data visualizations were created using R language (version 4.0.5) and GraphPad Prism (version 8.0). Sample size calculations were performed using PASS (version 11.0) prior to the study.

Results

Baseline Information of mTBI Patients with Integrated Nursing Interventions and Without Integrated Nursing Interventions

The inclusion and exclusion criteria are detailed in Figure 1. A total of 246 patients with mild Traumatic Brain Injury (mTBI) were included, of whom 138 received Integrated Nursing Interventions, and 108 received no such interventions. Both groups were comparable in terms of gender distribution, age, spine trauma, use of hemostatic agents on admission, hypotension on arrival, Glasgow Coma Scale (GCS) score on admission, hypoxia, surgical interventions, vital signs on admission, the mechanism of injury, type of mTBI, injury site, and heart rate ($P > 0.05$).

Notably, the Integrated Nursing Interventions group had a slightly higher proportion of traffic accidents (68.8% vs 60.2%), diffuse brain injury (52.9% vs 55.6%), and injury site of 1 (70.3% vs 71.3%) but a lower proportion of high falls (13.8% vs 13.9%), focal brain injury (36.2% vs 35.2%), and injury site of ≥3 (5.8% vs 3.7%) compared to the No-Integrated Nursing Interventions group.

The median values and interquartile ranges for systolic blood pressure, diastolic blood pressure, heart rate, and body temperature were not significantly different between the two groups (Table 1).

Complications of mTBI in Patients Receiving Integrated Nursing Interventions versus Those Receiving No Integrated Nursing Interventions

The incidence of complications differed between patients who received Integrated Nursing Interventions and those who did not. Patients receiving Integrated Nursing Interventions had a significantly lower incidence of perioperative intracranial hemorrhage (4.3% vs 12.0%, P=0.025), shorter hospital stays (6±2 vs 11±3 days, $P<0.001$), and a reduced rate of respiratory complications (0.7% vs 5.6%, P=0.024). Additionally, postoperative infections were lower in the Integrated Nursing Interventions group (0% vs 12.0%, $P<0.001$), with significantly higher satisfaction levels among patients and their families (94.2% vs 75.0%, $P<0.001$).

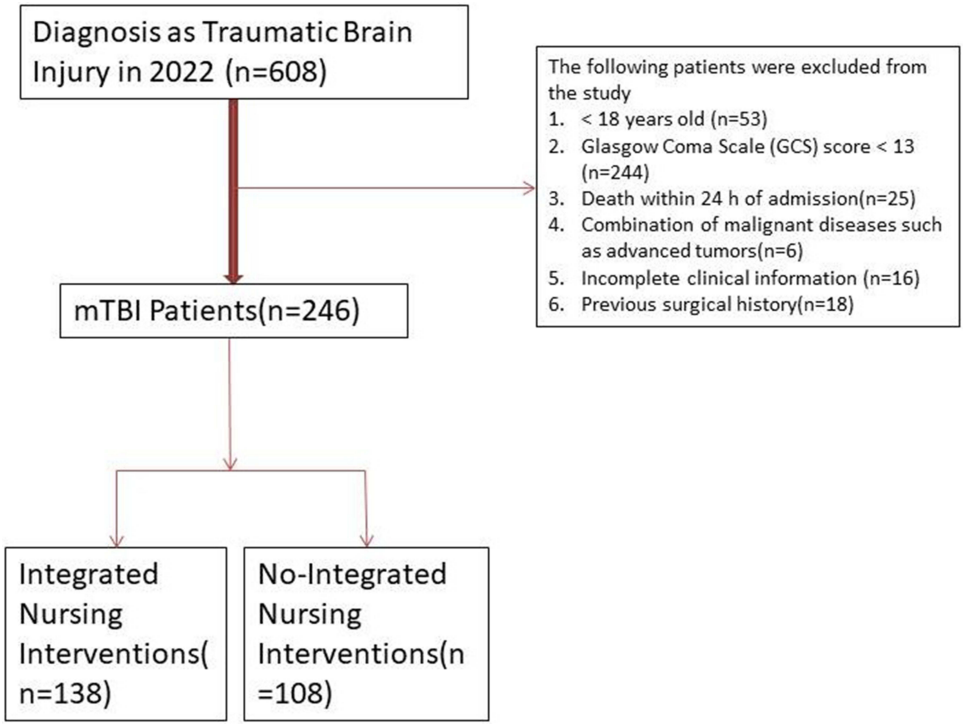

Figure 1 Inclusion and exclusion table for mTBI patients.

No significant differences were observed in circulatory, urinary, digestive, or coagulation complications between the two groups. These findings indicate that Integrated Nursing Interventions may reduce the risk of some complications associated with mTBI and contribute to shorter hospital stays compared to the No-Integrated Nursing Interventions group (Table 2).

Table 1 Baseline Information of Patients with mTBI at ED Apartment (N = 246)

		Integrated Emergency Nursing Interventions (n=138)	**No- Integrated Emergency Nursing Interventions (n=108)**	**P-value‡**
Gender				0.607
	Male	80 (58.0)	59 (54.6)	
	Female	58 (42.0)	49 (45.4)	
Age				0.874
	≤80	111 (80.4)	86 (79.6)	
	>80	27 (19.6)	22 (20.4)	
Spine Trauma				0.330
	No	111(80.4)	92(85.2)	
	Yes	27(19.6)	16(14.8)	
Mechanism of injury				0.406
	Traffic accident	95(68.8)	65(60.2)	
	High fall	19(13.8)	15(13.9)	
	Stumble	10(7.2)	13(12.0)	
	Others§	14(10.1)	15(13.9)	
Use of hemostatic agents on admission‡				0.349
	No	46(33.3)	30(27.8)	
	Yes	92(66.7)	78(72.2)	

(*Continued*)

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Table 1 (Continued).

		Integrated Emergency Nursing Interventions (n=138)	No- Integrated Emergency Nursing Interventions (n=108)	P-value‡
Hypotension (BP ≤ 90) on arrival				0.467
	No	133(96.4)	102(94.4)	
	Yes	5(3.6)	6(5.6)	
Type of mTBI				0.882
	Diffuse brain injury	73(52.9)	60(55.6)	
	Focal brain injury	50(36.2)	38(35.2)	
	Uncategorized	15(10.9)	10(9.3)	
Injury site				0.747
	1	97(70.3)	77(71.3)	
	2	33(23.9)	27(25.0)	
	≥ 3	8(5.8)	4(3.7)	
Hypoxia				0.730
	No	114(82.6)	91(84.3)	
	Yes	24(17.4)	17(15.7)	
Surgical interventions				0.413
	Decompressive craniectomy	66(47.8)	46(42.6)	
	Hematoma evacuation	72(52.2)	62(57.4)	
Vital signs in admission				
Systolic blood pressure (mmHg)		120(101–138)	124 (106–148)	0.074
Diastolic blood pressure (mmHg)		77 (62–88)	74 (61–89)	0.193
Heart rate (bpm)		97 (89–110)	96 (84–117)	0.226
Body temperature (°C)		36.5 (36.1–37.0)	36.4 (35.9–36.9)	0.176

Note: The values in parentheses are percentages unless indicated otherwise.‡ χ^2 test with Yates' correction. § Sharps injuries, firearm injuries, etc. ‡Use of anticoagulants or antiplatelet drugs.
Abbreviations: mTBI: Mild Traumatic Brain Injury; BP:Blood pressure.

Table 2 Comparison of mTBI Complications in Integrated Nursing Interventions Group and No-Integrated Nursing Interventions (N = 246)

		Integrated Emergency Nursing Interventions (n=138)	No-Integrated Nursing Interventions (n=108)	P-value‡
Perioperative complication				
Intracranial hemorrhage				0.025
	No	132(95.7)	95(88.0)	
	Yes	6(4.3)	13(12.0)	
Hospital stays		6±2	11±3	<0.001
Non-neurological complication				
Circulatory				0.442
	No	135(97.8)	107(99.1)	
	Yes	3(2.2)	1(0.9)	
Respiratory				0.024
	No	137(99.3)	102(94.4)	
	Yes	1(0.7)	6	
Digestive				0.515
	No	132(95.7)	105(97.2)	
	Yes	6(4.3)	3(2.8)	

(*Continued*)

Table 2 (Continued).

		Integrated Emergency Nursing Interventions (n=138)	No-Integrated Nursing Interventions (n=108)	P-value‡
Urinary				0.277
	No	134(97.1)	107(99.1)	
	Yes	4(2.9)	1(0.9)	
Coagulation				0.955
	No	134(97.1)	105(97.2)	
	Yes	4(2.9)	3(2.8)	
Infection				<0.001
	No	138(100.0)	95(88.0)	
	Yes	0(0.0)	13(12.0)	
Patient/family satisfaction				<0.001
	No	8(5.8)	27(25.0)	
	Yes	130(94.2)	81(75.0)	

Note: The values in parentheses are percentages unless indicated otherwise. ‡ χ^2 test or Fisher's test.
Abbreviations: mTBI: Mild Traumatic Brain Injury; GCS: Glasgow Coma Scale.

Univariate and Multivariate Logistic Regression Analyses of Risk Factors Associated with in-Hospital Mortality in mTBI Patients

In the univariate analysis, hypotension on arrival (P=0.013), GCS score on admission (P<0.001), and Integrated Nursing Interventions (P<0.001) were significantly associated with in-hospital mortality. In the multivariate analysis, hypotension on arrival (P=0.007), GCS score on admission (P<0.001), and Integrated Nursing Interventions (P<0.001) remained significant predictors of in-hospital mortality.

Specifically, patients without hypotension on arrival had a lower risk of in-hospital mortality compared to those with hypotension (OR=0.893, 95% CI: 0.785–0.912). Patients who received Integrated Nursing Interventions had a significantly lower risk of in-hospital mortality (OR=1.828, 95% CI: 1.619–2.318).

Other variables such as gender, spine trauma, mechanism of injury, use of hemostatic agents on admission, type of mTBI, and injury site were not significantly associated with in-hospital mortality (Table 3).

Table 3 Univariate and Multivariate Logistic Regression Analysis of Risk Factors Associated with in-Hospital Mortality in mTBI Patients

Variables	Univariate Analysis			Multivariate Analysis		
	P	OR	95% CI	P	OR	95% CI
Spine Trauma	0.713					
Yes		1.098	1.013–1.410			
No		Ref	–			
Mechanism of injury	0.411					
Traffic accident		Ref	–			
High fall		1.186	0.941–1.348			
Stumble		0.690	0.417–1.216			
Others		1.080	0.904–1.314			
Use of hemostatic agents on admission	0.626					
Yes		Ref	–			
No		0.747	0.410–1.166			
Hypotension (BP ≤ 90) on arrival	0.013			0.007		
Yes		Ref	–		Ref	–
No		0.745	0.477–0.892		0.893	0.785–0.912

(*Continued*)

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Table 3 (Continued).

Variables	Univariate Analysis			Multivariate Analysis		
	P	OR	95% CI	P	OR	95% CI
Admission Destination	0.473					
General ward		Ref	–			
Intensive Care Unit		1.187	0.613–1.981			
Type of TBI	0.788					
Diffuse brain injury		Ref	–			
Focal brain injury		1.011	0.643–1.877			
Uncategorized		0.790	0.571–1.543			
Injury site	0.108					
1		Ref	–			
2		1.101	0.975–1.248			
≥ 3		1.341	0.993–1.388			
Integrated Nursing Interventions	<0.001			<0.001		
No		Ref	–		Ref	–
Yes		1.932	1.579–2.217		1.828	1.619–2.318

Abbreviations: OR: Odds ratios; mTBI: Mild Traumatic Brain Injury; BP:Blood pressure.

Comparison of Clinical Prognostic Outcomes Between Integrated and No-Integrated Nursing Intervention Groups

The Integrated Nursing Interventions group had a significantly lower 30-day mortality rate (2.2%) compared to the No-Integrated Nursing Interventions group (8.3%), with a statistically significant difference (P=0.026). Similarly, the 90-day mortality rate was lower in the Integrated Nursing Interventions group (3.6%) compared to the No-Integrated Nursing Interventions group (11.1%), with a statistically significant difference (P=0.022).

Additionally, the readmission rate was significantly lower in the Integrated Nursing Interventions group (8.7%) compared to the No-Integrated Nursing Interventions group (18.5%, P=0.023). Overall, these results suggest that Integrated Nursing Interventions improve short-term survival outcomes and reduce the readmission rate for patients with mTBI (Table 4).

Effectiveness of Integrated Nursing Interventions on 30-Day Mortality, 90-Day Mortality, and Readmission Rates

ROC curves were utilized to evaluate the short-term clinical prognostic efficacy of Integrated Nursing Interventions in predicting 30-day mortality, 90-day mortality, and readmission rates. The area under the curve (AUC) was 0.836 for 30-day mortality, 0.760 for 90-day mortality, and 0.757 for the readmission rate, indicating good predictive performance for these outcomes (Figure 2).

Table 4 Comparison of Clinical Prognostic of TBI Between Integrated Nursing Intervention Group and No Integrated Nursing Intervention Group (N = 246)

		Integrated Nursing Interventions (n=138)	No-Integrated Nursing Interventions (n=108)	P-value‡
Readmission rate	Readmission numbers (%)	12(8.7)	20(18.5)	0.023
30-day mortality	Death numbers (%)	3(2.2)	9(8.3)	0.026
90-day mortality	Death numbers (%)	5(3.6)	12(11.1)	0.022

Note: ‡ χ^2 test or Fisher's test.

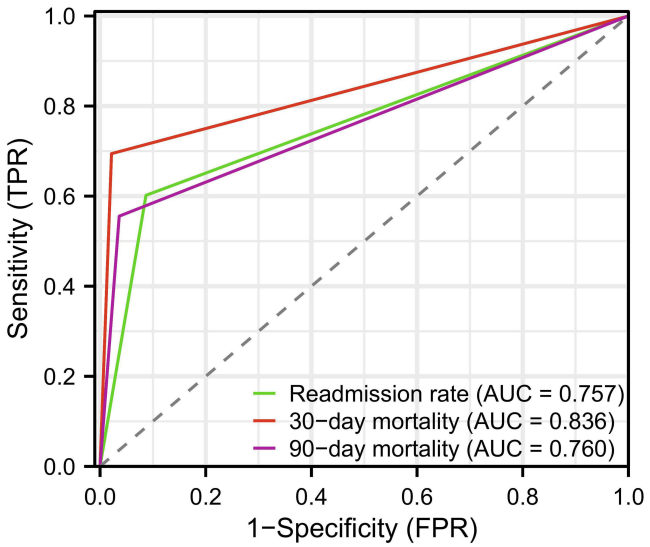

Figure 2 Effectiveness of integrated nursing interventions on 30-day mortality, 90-day mortality and readmission rates.

Discussion

Traumatic brain injury (TBI) remains a significant cause of mortality and disability worldwide, necessitating effective management strategies to reduce complications and improve survival outcomes.[1,19] Our study aimed to assess the effectiveness of integrated nursing interventions in patients with mild traumatic brain injury (mTBI) treated in the emergency department (ED).[20] The findings demonstrate that integrated nursing interventions are associated with improved short-term survival outcomes and a reduced incidence of complications among patients with mTBI.

The management of emergency nursing care has always been a key focus of research, and our study adds to the growing body of evidence supporting the effectiveness of integrated nursing interventions. Specifically, we found that patients who received integrated nursing interventions had significantly lower 30-day and 90-day mortality rates compared to those who did not receive such interventions. These findings align with previous studies that have shown nurse-led interventions to be effective in improving patient outcomes across various clinical settings. For example, Blackmore et al[21] identified the benefits of a nurse-driven rapid reversal protocol for TBI patients on anticoagulant therapy, which led to improved care processes. Similarly, our study demonstrates that early assessment, timely interventions, and collaborative care planning significantly improve patient outcomes in TBI management.

Additionally, integrated nursing interventions in our study were associated with a significant reduction in perioperative intracranial hemorrhage, respiratory complications, and infections during hospitalization. This sentence could be made slightly more concise: “If not promptly managed, these complications can prolong hospital stays and negatively affect the quality of life of TBI patients.The decrease in infection rates and respiratory complications ($P<0.05$) emphasizes the importance of comprehensive nursing care in preventing common postoperative issues. Similar findings have been documented by Jones et al[22] who demonstrated that early interventions and thorough patient education were key in reducing complication rates in surgical patients. Likewise, Smith et al[23] highlighted the role of timely nursing interventions in minimizing the risk of respiratory and infectious complications, further supporting the effectiveness of such approaches in TBI management.

Another key finding of our study is the significant reduction in the length of hospital stay for patients receiving integrated nursing interventions. On average, patients in this group stayed for 6±2 days, compared to 11±3 days for those in the no-intervention group. Shorter hospital stays not only reduce healthcare costs but also lessen the psychological and emotional strain on patients and their families. This conclusion is consistent with the findings of Brown et al[24] who reported that structured nursing interventions in emergency care improved resource utilization and patient well-being. Additionally, Green et al[25] demonstrated that efficient nursing protocols significantly reduced hospital stays while

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enhancing overall patient satisfaction, reinforcing the idea that comprehensive nursing interventions lead to better clinical outcomes in emergency settings.

However, our study does have some limitations. First, the retrospective nature of the research limits our ability to establish a direct cause-and-effect relationship between nursing interventions and patient outcomes. Furthermore, the study was conducted at a single institution, which may limit the generalizability of the findings to other healthcare settings. Future studies with larger, multicenter designs and prospective methodologies are necessary to validate these results and establish more robust guidelines for TBI management in the ED. In the mean time, we acknowledge that the results of this study may vary depending on factors such as the population characteristics and geographic distribution. These factors can influence the generalizability of our findings, as different populations may have varying healthcare access, cultural practices, and health behaviors that affect the outcomes of integrated nursing interventions for mTBI. For example, patients in urban areas may have quicker access to healthcare services compared to those in rural regions, which could influence the timing and effectiveness of interventions. Additionally, the demographic makeup of the population, such as age, gender, and comorbidities, could also impact the effectiveness of the interventions. Therefore, future research should explore these factors across diverse populations and geographic settings to validate and further generalize our findings. By considering the variations in population and geographic factors, we can better understand the broader applicability of integrated nursing interventions for mTBI and refine care protocols accordingly.

Finally, standardized protocols for implementing nursing interventions in the ED are critically needed. Our findings underscore the importance of such protocols to ensure consistent and effective care for TBI patients. The lack of standardized procedures may lead to variability in patient outcomes, highlighting the urgent need for further research and the development of evidence-based guidelines to optimize TBI care in emergency settings.

Conclusion

In conclusion, this study demonstrates that integrated nursing interventions significantly improve short-term survival outcomes and reduce complications in patients with mild traumatic brain injury (mTBI) in the emergency department (ED). The findings suggest that these interventions are not only effective in reducing mortality rates but also in minimizing the incidence of hospital-acquired infections and respiratory complications. While the focus of our study was on short-term outcomes, it is important to note that further exploration of long-term recovery, including cognitive rehabilitation and post-discharge outcomes, is warranted. Additionally, integrated nursing interventions may improve long-term outcomes through mechanisms such as patient education, early rehabilitation, and multidisciplinary collaboration. These components contribute to better overall recovery and may enhance the effectiveness of care. Our research provides compelling evidence for the development of standardized nursing protocols, which could not only enhance the quality of care provided to TBI patients in emergency settings but also reduce healthcare costs by preventing complications and improving patient outcomes.

Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participation

Written informed consent was obtained from all participants. This research was performed in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Xijing Hospital.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically

reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors have no conflicts of interest to declare for this work.

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