Health Science Reports

WILEY

Health Science Reports
Open Access

ORIGINAL RESEARCH OPEN ACCESS

Retrospective Analysis of the Impact of a Collaborative Multidisciplinary Care Model on the Efficiency of Emergency Care and Neurological Function and Prognosis of Comatose Patients With Emergency Cerebral Hemorrhage

Yanbin Li[1] | Fang Wang[2]

[1]Department of Critical Care Medicine, the First Affiliated Hospital of Soochow University, Suzhou, China | [2]Department of Emergency, the First Affiliated Hospital of Soochow University, Suzhou, China

Correspondence: Fang Wang (w5h2r5@sina.com)

Received: 29 April 2024 | **Revised:** 19 December 2024 | **Accepted:** 17 January 2025

Funding: The authors received no specific funding for this work.

Keywords: collaborative multidisciplinary care model | coma | emergency cerebral hemorrhage | emergency efficiency | neurological function | prognosis

ABSTRACT

Background and Aims: Cerebral hemorrhage is often accompanied by severe neurological function damage. The collaborative multidisciplinary care means multidisciplinary medical personnel work together. This study investigated the effects of a collaborative multidisciplinary care model on the prognosis of comatose patients with cerebral hemorrhage in emergency medicine.

Methods: The control group was given routine care, and the study group was given a collaborative multidisciplinary care model intervention. Record the success rate of first aid and the changes in neurological function. Patients were followed up for 6 months, and mortality and disability rates were recorded. SPSS 23.0 software was used to analyze the data, and the count data were expressed as [cases (%)] by $\chi 2$ test, and the measurement data were expressed as $(x \pm s)$ by t-test.

Results: The success rate of first aid in the control group and the study group was 91.13% and 94.34%, respectively, which was significantly lower than that of the control group ($p < 0.05$); the time for intravenous medication and the total time for first aid in the study group were significantly lower than that of the control group ($p < 0.001$). After the intervention, MMSE scores, FMA scores, and Barthel indexes were significantly higher with lower NIHSS scores in the study group than in the control group ($p < 0.05$). Compared with the pre-intervention period, all scores of motor, speech, and eye-opening were significantly higher in both groups, and the study group was significantly higher than the control group after the intervention ($p < 0.05$). The complication rate and disability rate of the study group were lower than that of the control group ($p < 0.05$).

Conclusion: A collaborative multidisciplinary care model for comatose patients with cerebral hemorrhage may improve the efficiency of emergency care, improve the patient's neurological function, reduce the disability rate of the patients, and improve the prognosis of the patients.

Summary

- Collaborative multidisciplinary nursing mode elevated the success rate and time of first aid for comatose patients with acute ICH.
- Collaborative multidisciplinary nursing mode improved the motion, language and eye-opening score, nervous function, limb function, and daily living ability of comatose patients with acute ICH.
- Collaborative multidisciplinary nursing mode decreased the incidence of complications and improved the prognosis of comatose patients with acute ICH.

1 | Introduction

Intracerebral hemorrhage (ICH) is a hemorrhagic disease caused by non-traumatic factors, which is characterized by rapid onset and severe conditions. Because of the particularity of the location of ICH, it is easy to oppress the patient's brain tissue and nerves after the onset of the disease, resulting in a high disability and mortality rate. Even if some patients survive, they are commonly accompanied by neurological, motor, and cognitive dysfunction to varying degrees, which directly affects the prognosis and rehabilitation of patients. According to relevant statistics, ICH accounts for 10%–20% of all stroke diseases [1]. Thus, improving the prognosis of patients is key to controlling the bleeding status and brain injury status of patients as soon as possible.

At present, minimally invasive surgery is mostly used for the treatment of this disease in clinical practice, but due to the loss of nerve function, cognitive impairment often occurs after surgery. However, the clinical effect of routine nursing methods is limited, so more appropriate nursing plans are needed. With the continuous progress of medical science and technology, it has been found that [2], the application of clustered nursing in patients with hypertensive ICH is feasible, and its nursing effect is remarkable, which can not only reduce the incidence of postoperative complications, but also improve patients' compliance and quality of life, and has good application value. The cooperative multidisciplinary nursing model is a new nursing model for specific diseases based on the concept of evidence-based medical nursing, which adheres to the patient-centered approach and is based on multi-center randomized clinical nursing research, thus being conducive to improving the quality of medical care and achieving homogeneous management [3]. As a new type of nursing model, cooperative multidisciplinary nursing can enable patients to receive treatment as quickly as possible and improve the success rate of rescue through multidisciplinary collaboration. Previous studies have applied cooperative multidisciplinary nursing to the care of cervical cancer, pancreatic cancer, and other diseases [4, 5]. At present, there is no report on the application of collaborative multidisciplinary nursing in emergency ICH patients, so this study hypothesized that a collaborative multidisciplinary care model could improve the emergency efficiency of coma patients with emergency ICH, improve the neurological function of patients, and optimize the prognosis of patients.

The present study aimed to explore the effects of a collaborative multidisciplinary care model on the first aid efficiency, neurological function, and prognosis of comatose patients with emergency ICH, aiming to provide a reference for nursing treatment of clinical diseases.

2 | Materials and Methods

2.1 | General Materials

This was a retrospective observational study, and simple random sampling was used to determine the range of cases to be analyzed [6]. A total of 106 ICH patients admitted to the emergency department of the First Affiliated Hospital of Soochow University from February 2020 to May 2022 were selected as the research subjects by retrospective survey and stratified fixed-ratio sampling. This study was approved by the Ethics Committee of the First Affiliated Hospital of Soochow University. Patients were in a coma defined as a state of complete loss of consciousness, unresponsiveness to the outside world, and inability to wake up from stimuli. They were randomized as the study group (53 cases) and the control group (53 cases) according to the different intervention methods. For the missing data of cases, the single interpolation method was used to fill the missing values. Inclusion criteria: (1) All patients satisfied the clinical symptoms of ICH and were confirmed by imaging examination. (2) Patients with a Glasgow coma scale (GCS) score of ≤ 8. (3) Patients who had symptoms such as elevated blood pressure, headache, vomiting, and paralysis of limbs, and were in a semi-coma or coma when they arrived at our hospital. (4) Patients who were not more than 24 h from the onset of illness were sent to the emergency department for treatment. (5) Patients who were out of danger after emergency treatment and whose mental consciousness could return to a conscious state. Patients and their families gave informed consent and signed informed consent forms (during the signing process, ensured that patients or their legal representatives (such as family members) understood the nature, purpose, potential risks, and benefits of the study and voluntarily consent to participate in the study. For comatose patients, because they were unable to express their wishes, their family members exercised their right to informed consent). Exclusion criteria: (1) Patients with recurrence of ICH who have been complicated by increased intracranial pressure, epilepsy, deep vein thrombosis, pulmonary embolism, cerebrocardiac syndrome, and other diseases before the start of this study. (2) Organ tissue lesions and disabilities. (3) Due to the severity of the patient's condition, the patient had no vital signs when they arrived at this hospital and was declared clinically dead after rescue efforts failed. (4) Patients with a history of ICH.

2.2 | Data Collection

This study was approved by the hospital Ethics Committee and conformed to medical ethics. The study group included 33 males and 20 females, aged from 32 to 80 years, with an average age of (48.72 ± 2.33) years. As for the bleeding sites, there were 32 cases of basal ganglia hemorrhage, 10 cases of hypothalamic hemorrhage, 5 cases of brainstem hemorrhage, and 6 cases of cerebellar hemorrhage. The control group included 30 males

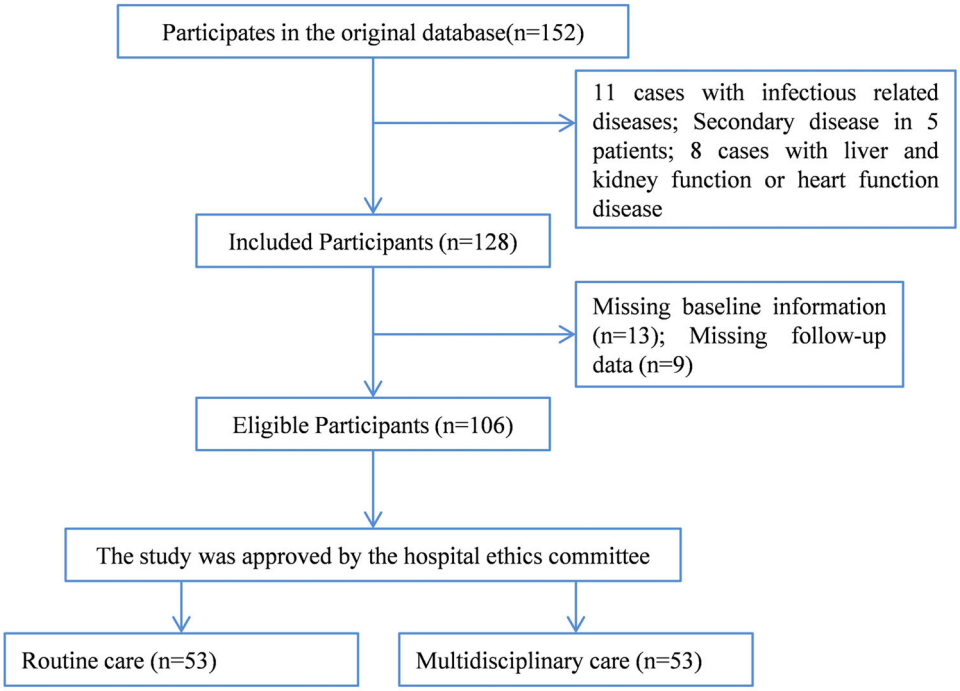

FIGURE 1 | The process of general information selection. After meeting the inclusion criteria and being grouped, a total of 106 patients were included in the study, including 53 in the study group and 53 in the control group.

and 23 females, aged from 36 to 79 years, with an average age of (47.20 ± 2.19) years. As for the bleeding sites, there were 30 cases of basal ganglia hemorrhage, 9 cases of hypothalamic hemorrhage, 7 cases of brainstem hemorrhage, and 7 cases of cerebellar hemorrhage. The process of general information selection is shown in Figure 1.

In this study, professional sample size calculation software G-power and PASS were used to input relevant parameters and get sample size suggestions. According to the selected statistical test method and significance level, the sample size of 106 cases could ensure the efficiency of the statistical test and accurately distinguish the difference between the effect of intervention measures and random error. Efficacy analysis ensured that the selected sample size had sufficient efficacy to detect the true effect of the intervention.

2.3 | Methods

Patients in the control group received routine nursing, including condition monitoring, medication, diet, rest guidance, psychological counseling, health education, etc.

Based on the control group, patients in the study group were given collaborative multidisciplinary nursing [7–9]. The specific contents are as follows.

1. Establish a multidisciplinary cooperative nursing team: the nursing plan should be made according to the patient's examination and treatment plan. The team members perform their duties and cooperate, and the head nurse arranges the tasks. The doctor is responsible for answering questions about the disease of the patient and his family. The pharmacist is responsible for formulating the medication plan. Nurses are responsible for patient care-related work, health education, and follow-up. The medical staff in the rehabilitation department is responsible for the rehabilitation training of patients to ensure early recovery of patients.
2. Psychological nursing: Psychological consultants and nursing staff should actively communicate with patients and their families to understand their psychological conditions, living habits, and interests. Provide personalized psychological counseling, language encouragement, and action support, so that patients can realize the positive role of good attitude in disease rehabilitation. At the same time, the family members are urged to pay attention to and take care of the patients, so that the patients can feel the warmth of their families and enhance the treatment compliance and enthusiasm.
3. Condition nursing: Pay attention to the changes in the patient's condition. If the pulse is obviously accelerated and the blood pressure suddenly rises, be alert to the risk of intracranial hernia. In line with the patient's physical and basic conditions, the infusion speed and dosage of drugs should be reasonably controlled. Ensure the patient's respiratory tract is unobstructed, and timely aspirate the secretions in the trachea. Keep the patient in a high head and low foot position, and properly fix the bed pillow to avoid slipping. Monitor the patient's breathing condition and give oxygen treatment as appropriate. Assist the patient to turn over every 1 h and massage to prevent pressure sores. Keep aseptic operation for patients with indwelling catheters, and replace the drainage bag every day. Observe the stool and urine characteristics of patients to prevent infection and bleeding.

Patients in both groups received a 2-month nursing intervention.

2.4 | Outcome Measures

1. First aid efficiency: If the patient's hematoma is cleared, the vital signs return to normal and the consciousness is restored, the first aid is considered successful. Observe the success rate of first aid and record the time of first aid.
2. Comatose degree: Grass coma scale score [10] was used to evaluate the comatose degree of patients, including movement, language, and eye-opening, with 1–5 points for each item. Grass coma score was negatively correlated with the comatose degree of patients.
3. Neurological function: The Mini-Mental State Examination (MMSE) [11] and the National Health Research Stroke Scale (NIHSS) [12] were used to evaluate the neurological function of patients. MMSE scores include multiple scoring items, and each item is scored according to different criteria as follows: Orientation: Ask the current date, time, and place, and score 1 point for each correct answer, up to 5 points. Memory: The test subjects are asked to remember the names of three items and repeat them, scoring 1 point for each correct memory, up to 3 points. Attention and numeracy: Subtract 7 consecutive points from 100, and score 1 point for each correct answer, up to 5 points. Recall ability: The test subjects were asked to repeat the names of three items previously remembered, and each correct repetition scored 1 point, up to 3 points. Language ability: Items such as name, paraphrasing, three-step command, reading comprehension, writing, and structure ability are scored on a different scale, with a maximum score of 9. Visual space and executive function: Test subjects are asked to draw specific patterns, and each completed item is awarded 1 point. The total score of MMSE ranges from 0 to 30, with higher scores indicating better cognitive function, with 27–30 being normal, 21–26 mild cognitive impairment, 17–20 moderate cognitive impairment, and 10-16 severe cognitive impairment. NIHSS includes consciousness level, language ability, motor function, sensory function, visual function, ataxia, neglect symptoms, etc. Each item has a detailed scoring scale, and the overall score ranges from 0 to 42, with higher scores indicating more severe nerve injury.
4. Motor function: Fugl Meyer Motor Function Rating Scale (FMA) [13] and Barthel Index Rating Scale [14] were used to detect the changes in motor function and daily living ability of patients. FMA score: Sensory function: Tactile sensations involving the shoulders, arms, thighs, and soles of the feet, as well as proprioceptive sensations in the shoulders, elbows, wrists, thumbs, hips, knees, ankles, and toes, with an overall score of 24. Balance function: including sitting and standing balance test, a total of seven items, a total of 14 points. The total score is 38, and the higher the score, the better the exercise ability. The Barthel index rating scale includes eating, bathing, grooming, dressing, control of stool, control of urination, toilet use, bed and chair transfer, flat walking, and going up and down stairs. The score of each item ranges from 0 to 100 points. The higher the score, the stronger the self-care ability of the patient.
5. Incidence rate of complications: The incidence of complications in the two groups was recorded, and the complications included cerebral hernia, hypostatic pneumonia, and venous thrombosis of lower limbs. The cerebral hernia was confirmed by CT and magnetic resonance. CT examination could show that the basal cisterns, annular cisterns, and tetraassic cisterns could be deformed or disappeared when the tentorial notch herniation was detected, and the midline could be asymmetrical and displaced during the lower herniation. MRI examination found that the lesion site of the cisterns was deformed and disappeared, and the uncinate gyrus, hippocampus, diencephalic, brainstem, and cerebellar tonsils could be directly observed. Hypostatic pneumonia was examined by pulmonary imaging, which showed exudative consolidation and blurred edges with uneven density. Hypostatic pneumonia could be diagnosed according to typical symptoms, laboratory and imaging examinations. Color Doppler ultrasound showed blood flow filling defect or no blood flow signal, indicating the presence of venous thrombosis of lower limbs.
6. Prognosis: The follow-up was continued for 6 months, and the mortality and disability rates were counted.

2.5 | Addressing Bias and Handling Missing Data

1. Type of study: This was a retrospective observational study. To further strengthen the persuasive force, more rigorous study designs such as prospective cohort studies or randomized controlled trials might be considered in the future to further validate the effect of collaborative multidisciplinary care models on comatose patients with emergency ICH.
2. Selection and information bias: This study was retrospective and observational, and there was a risk of

TABLE 1 | Comparison of first aid success rate and first aid time [cases (%), ($\bar{x} \pm s$)].

Groups	Cases	First aid success rate (%)	First aid time (min)	
			Time of intravenous medication	Total time of first aid
The study group	53	50/53 (94.34)	3.64 ± 1.08	25.41 ± 5.73
The control group	53	43/53 (81.13)	8.73 ± 1.72	42.61 ± 6.39
χ^2/t		4.296	18.245	14.589
p		0.038	< 0.001	< 0.001

selection and information bias. To mitigate this bias, rigorous methods and criteria were applied in the study design and data analysis process, such as explicit inclusion and exclusion criteria, single interpolation to fill in missing values, and data analysis using professional statistical software. However, the influence of selection and information bias on the results cannot be completely excluded. Future studies should use more rigorous designs to reduce this bias.

3. Implementation bias: During the implementation of the intervention, we ensured that the baseline conditions of the study and control groups at the time of receiving care were as consistent as possible to adjust for confounding factors. At the same time, through the establishment of multidisciplinary collaborative care teams and the cooperation of professionals, the consistency and accuracy of interventions were ensured.

4. Handling missing data: In the process of data collection, the single interpolation method was used to fill in the missing data to ensure the integrity and accuracy of data analysis. Future research might consider using more complex missing data processing methods, such as multiple interpolations, to further improve the reliability and persuasiveness of the data.

2.6 | Statistical Analysis

In this study, the success rate of first aid and the incidence of complications were compared by Chi-square test to evaluate whether the differences between the control group and the study group were statistically significant. First aid time (including intravenous medication time and total emergency time) was compared using the Independent-samples *t*-test or the Mann–Whitney *U* test (when the data did not meet the normal distribution). For the changes in the scores of MMSE, NIHSS, FMA, and Barthel index, the Paired samples *t*-test or Wilcoxon signed rank test (when the data did not meet the normal distribution) were used to compare the differences before and after the intervention. Meanwhile, the independent sample *t*-test or Mann–Whitney *U* test was used to compare the score differences between the control group and the study group after intervention. To avoid false positive results due to multiple comparisons, Bonferroni correction was performed for the significance level of each comparison to reduce the overall false positive rate. In this study, SPSS 23.0 software was used for statistical analysis, and $p < 0.05$ was regarded as a statistically significant difference. All tests are two-sided tests. The effect size (Cohen's *d*) was estimated using JASP 0.15 statistical software to show the size of the difference between the groups.

The control group received routine care, while the observation group implemented a collaborative multidisciplinary care model based on routine care. This design ensured that the baseline conditions of the two groups of patients were as consistent as possible when receiving care, which helped to adjust confounding factors. Statistical software such as SPSS was used for data analysis, and *t*-test and other methods were used to compare the emergency response efficiency, neurological function, and prognosis of two groups of patients, to objectively evaluate the effectiveness of the collaborative multidisciplinary care model.

TABLE 2 | Comparison of the degree of coma between the two groups before and after nursing.

Group	Time	The study group ($n = 53$)	The control group ($n = 53$)	Difference (95% CI)	Adjusted *p*
Motion	Before nursing	2.30 ± 0.58	2.28 ± 0.69	−0.02 (−0.04 to 1.48)	0.053
	After nursing	3.85 ± 0.63	3.07 ± 0.43	0.78 (0.25–2.87)	0.001
Language	Before nursing	2.17 ± 0.91	2.21 ± 1.01	0.04 (−0.08 to 1.79)	0.069
	After nursing	3.66 ± 1.04	3.11 ± 1.10	0.55 (0.19–2.09)	0.001
Eye-opening	Before nursing	2.00 ± 0.92	2.02 ± 0.87	0.02 (−0.06 to 1.63)	0.105
	After nursing	3.64 ± 0.68	3.28 ± 0.63	0.36 (0.10–2.01)	0.012
Total	Before nursing	6.47 ± 1.51	6.51 ± 1.20	0.04 (−0.02 to 1.74)	0.097
	After nursing	11.15 ± 1.43	9.47 ± 1.37	1.68 (1.03–3.42)	0.001

3 | Results

3.1 | Effects of Collaborative Multidisciplinary Care Model on the Success Rate and Time of First Aid for Comatose Patients With Emergency ICH

The success rates of first aid in the control group and the study group were 81.13% and 94.34% respectively, which were much lower in the study group ($p = 0.038$). After Bonferroni correction, the difference was still statistically significant ($p = 0.042$). Effect size analysis showed that the first aid success rate of the study group was 3.21% higher than that of the control group (absolute risk reduction value), and the relative risk was reduced by about 29%. Compared with the control group, the time of intravenous medication and the total time of emergency treatment in the study group were largely shortened ($p < 0.001$, Table 1).

3.1.1 | Effects of Collaborative Multidisciplinary Care Model on Coma Degree of Comatose Patients With Emergency ICH

After nursing, the motion, language, and eye-opening scores in the two groups were all notably increased ($p = 0.016$, $p < 0.001$, $p = 0.039$, $p = 0.003$). Further effect size analysis obtained Cohen's d values of 5.825 (95% CI: 1.267–8.774), 3.526 (95% CI: 2.637–5.667), 4.268 (95% CI: 2.097–7.604), 5.771 (95% CI: 1.874–6.321), Table 2 and Figure 2).

3.1.2 | Effects of Collaborative Multidisciplinary Care Model on the Nervous Function of Comatose Patients With Emergency ICH

There was no significant difference in MMSE and NIHSS between the two groups before nursing ($p > 0.05$). After nursing, the MMSE scores of the two groups were both increased. Further effect size analysis obtained Cohen's d values of 3.748 (95% CI: 1.748–4.980) and 5.749 (95% CI: 1.697–4.880) ($p < 0.001$, Table 3 and Figure 3).

3.1.3 | Effects of Collaborative Multidisciplinary Care Model on Limb Function and Daily Living Ability of Comatose Patients With Emergency ICH

There existed no significant difference in FMA score and Barthel index between the two groups before nursing ($p > 0.05$). After nursing, the FMA score and Barthel index of the two

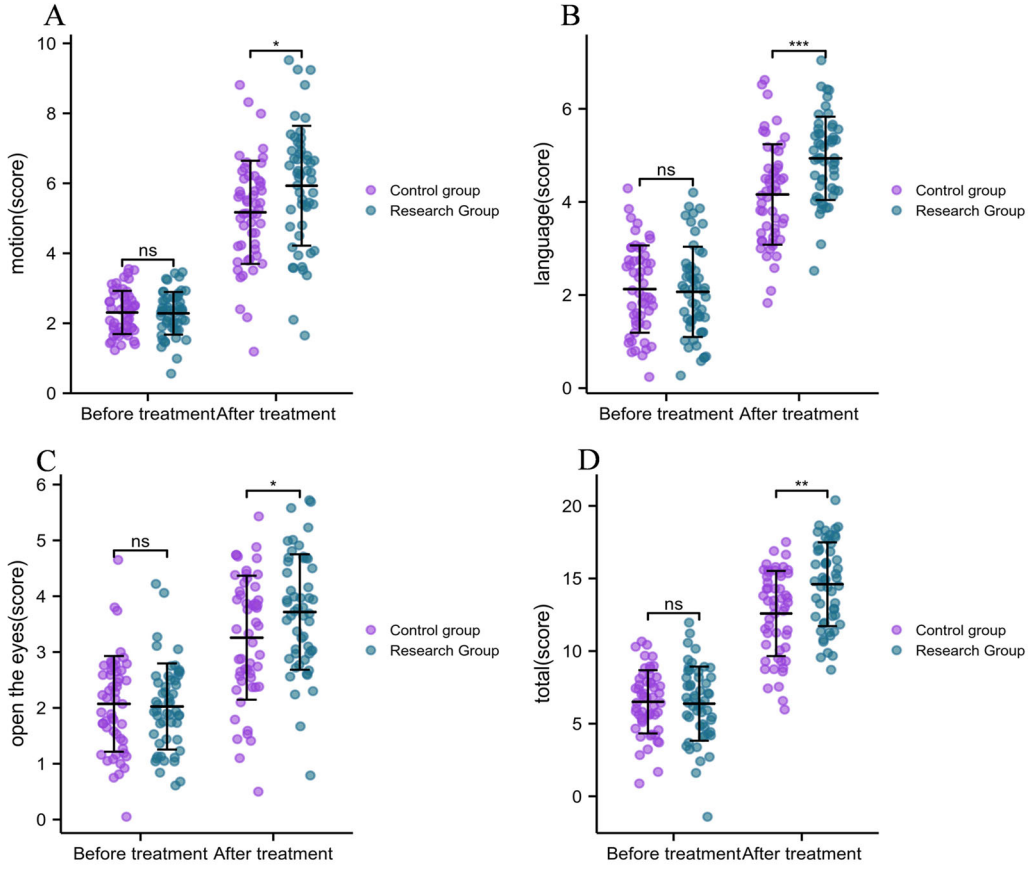

FIGURE 2 | Comparison of motion scores, language scores, open eyes scores, and total scores before and after the intervention. The data in the figures were derived from the Glasgow Coma Scale, which reflected the recovery of patients before and after the intervention of the collaborative multidisciplinary care model. (A) Comparison of motion scores between the two groups. (B) Comparison of language scores between the two groups. (C) Comparison of open eyes score between the two groups. (D) Comparison of total scores between the two groups. ns means $p > 0.05$ compared with the control group; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ compared with the control group after nursing.

groups were both increased ($p = 0.018$, $p = 0.008$). Further effect size analysis obtained Cohen's d values of 4.261 (95% CI: 2.330–7.150) and 6.821 (95% CI: 3.871–10.302) (Table 4 and Figure 4).

3.1.4 | Effect of Collaborative Multidisciplinary Care Model on the Incidence of Complications in Comatose Patients With Emergency ICH

The complication incidence of the study group was 13.21%, which was significantly lower than that of the control group (33.96%), and the difference between the two groups was statistically significant ($p = 0.012$). Effect size analysis showed that the complication incidence of the study group was increased by about 20.75% (absolute added risk), and the relative risk was increased by about 1.58 times compared with the control group (Table 5).

3.1.5 | Effect of Collaborative Multidisciplinary Care Model on the Prognosis of Comatose Patients With Emergency ICH

The disability rate and mortality rate in the study group and the control group were 16.98%, 9.43%, 37.74%, and 13.21%, respectively. The disability rate was much lower in the study group than in the control group ($p = 0.017$). Effect size analysis showed that the disability rate in the study group was reduced by about 20.76% compared with the control group (absolute risk reduction value), and the relative risk was reduced by about 55%. Forty-eight cases in the study group and 46 cases in the control group needed treatment, and there was no significant difference in mortality between the two groups ($p > 0.05$). The details are shown in Table 6.

4 | Discussion

There are many influencing factors of ICH, and it can change greatly in a short time. Delayed rescue or improper treatment can easily lead to increased mortality. Even if the treatment is successful, the sequelae caused by this disease will also have a negative impact on the prognosis of patients, such as severe neurological impairment and cognitive dysfunction, which will have a great negative impact on patients and their families [15]. Inappropriate and untimely nursing operations cause a waste of time, thus delaying the best time for patient rescue. Therefore, in addition to improving treatment technology, appropriate nursing intervention plays an important role in improving patients' enthusiasm for treatment, reducing the mortality and disability rate of patients as far as possible, and improving the prognosis of patients.

More and more studies have shown that proper nursing can significantly improve the treatment rate and prognosis of patients [16, 17]. The collaborative multidisciplinary care model is a series of standardized, individualized, and comprehensive nursing services developed from a multidisciplinary perspective. Compared with traditional nursing, it pays more attention

TABLE 3 | Comparison of the nervous function between the two groups before and after nursing.

Group	Time	The study group ($n = 53$)	The control group ($n = 53$)	Difference (95% CI)	Adjusted p
MMSE	Before nursing	12.84 ± 2.59	12.76 ± 2.97	0.08 (−0.30 to 0.46)	0.075
	After nursing	24.76 ± 1.75	20.34 ± 1.64	4.42 (2.89–7.31)	0.001
NIHSS	Before nursing	33.02 ± 4.42	32.96 ± 2.63	0.06 (−0.17 to 0.85)	0.098
	After nursing	20.11 ± 3.72	24.94 ± 4.51	−4.83 (−5.05 to 2.68)	0.001

Note: There were three patients (5.66%) with missing data in the MMSE score. For these missing data, a single interpolation method was used to fill in the missing data to ensure the integrity and accuracy of data analysis.

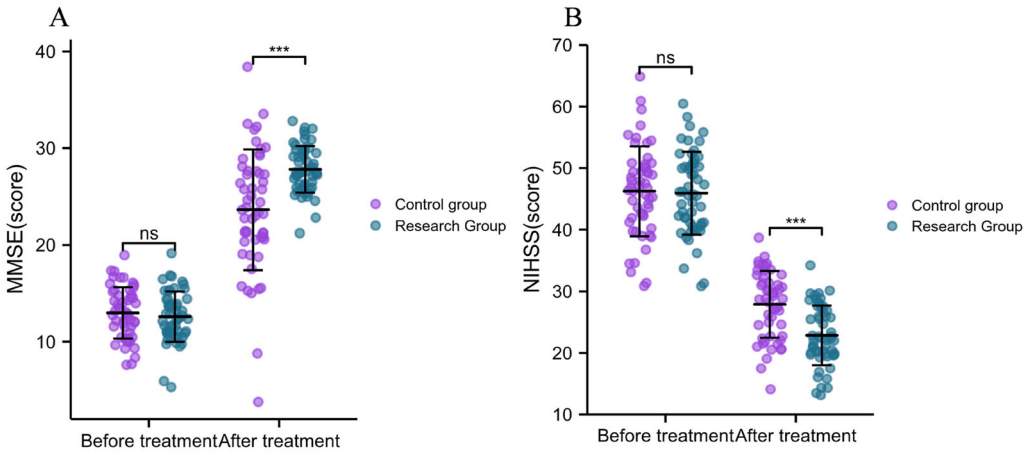

FIGURE 3 | Comparison of MMSE and NIHSS scores of neurological function between the two groups before and after intervention. (A) Comparison of MMSE scores between the two groups. (B) Comparison of NIHSS scores between the two groups. ns means $p > 0.05$ compared with the control group; ***$p < 0.001$ compared with the control group after nursing.

to team spirit and advocates patient-centered. Nurses are responsible for organization, coordination, feedback, and decision-making in the nursing process. At present, the collaborative multidisciplinary care model has been widely used in clinical nursing and has achieved prominent results. This study investigated the effects of collaborative multidisciplinary care model on emergency efficiency, neurological function, and prognosis of coma patients with emergency ICH. We found that the collaborative multidisciplinary care model could substantially increase the success rate of first aid and shorten the first aid time. However, many reasons affect the treatment efficiency of patients. Timely and effective treatment is an important element to improve the prognosis of ICH patients. Conventional first aid measures often have certain loopholes that delay the treatment of patients, such as unclear division of responsibilities of medical personnel. The cooperative multidisciplinary nursing mode operates based on multidisciplinary cooperation, which can avoid repetition and omission in the rescue process as much as possible, and largely enhance work efficiency. Although the success rate of first aid in the two groups was small, considering the potential impact of the improvement of the success rate of first aid on the overall prognosis and quality of life of patients, even if the improvement of the success rate of first aid was not large, every percentage point increase might mean that more patients' lives could be saved or the quality of life could be improved in such diseases as emergency ICH with high incidence and high mortality. Studies have shown that nurse-led methods can strengthen the blood pressure management of patients with emergency ICH, thus significantly improving the treatment efficiency of patients with emergency ICH and shortening the first aid time [18]. Other studies indicate that nursing intervention and quality feedback strategies under the guidance of stress system theory can effectively improve the neurological recovery ability and posttraumatic growth level of patients with cerebral hemorrhage, and have significant effects on improving the psychological state and quality of life of patients [19]. In addition, in patients with severe trauma in the emergency ICU, the adoption of early multidisciplinary collaborative nursing mode can shorten the duration of rescue and ICU stay, and reduce the incidence of delirium in patients, thereby improving the success rate of rescue. This model not only optimizes the nursing process, but also improves the accuracy of nursing decisions and accelerates the emergency response. Combined with the results of this study and the above references, we can see the importance of nursing in emergency ICH patients, and the collaborative multidisciplinary care model can give full play to the advantages of various specialties, realize the optimal allocation of resources, and thus improve the quality and efficiency of nursing [20]. In line with the research of Aminizadeh et al. [21], although this study does not directly involve artificial intelligence (AI) and distributed systems, the collaborative multidisciplinary care model also emphasizes the synergy and efficiency of medical services. The application of AI and distributed systems in medical services, such as telemedicine and intelligent diagnostic assistance, also provides new ways to improve the quality of medical services.

Nerve function injury is an important complication in patients with ICH. ICH leads to mechanical injury of brain tissue and space-occupying effect of hematoma, thus inducing the apoptosis of extensive nerve cells. With the progression of ICH, the hemorrhagic injury gradually worsened, and the nerve cells began to necrosis [22]. This study found that the patient's neurological function, limb function, and daily living ability were improved, and the patient's coma was reduced by a collaborative multidisciplinary care model, which was similar to the following research results. In the study of Yang et al. [23], the neurological function of patients with ICH was impaired, and early clinical pathway nursing could promote the recovery of patients' neurological function. In the study of Zhang et al. [24], humanized nursing could dramatically improve patients' limb motor function, reduce the degree of neurological impairment, and improve the quality of life and nursing satisfaction. This may be because the central nervous system and brain tissue cells have certain plasticity. Timely treatment of injured brain tissue plays an important role in promoting the recovery of neurological function in patients [25]. A collaborative multidisciplinary care model can effectively improve the balance of patients' body system, create a good rehabilitation environment, promote patients to establish good health management knowledge, effectively solve the problems that may

TABLE 4 | Comparison of limb function and daily living ability ($\overline{x} \pm s$), (score).

Group	Time	The study group ($n = 53$)	The control group ($n = 53$)	Difference (95% CI)	Adjusted p
FMA score	Before nursing	6.20 ± 1.17	6.35 ± 1.18	−0.15 (−0.24 to 1.36)	0.087
	After nursing	25.31 ± 8.40	21.62 ± 7.37	3.69 (1.15–7.36)	0.001
Barthel index	Before nursing	33.19 ± 5.46	34.12 ± 5.51	−0.93 (0.11–1.98)	0.104
	After nursing	56.41 ± 8.28	52.27 ± 7.40	3.83 (1.65–6.89)	0.001

occur in ICH, and jointly improve the clinical performance of patients to promote rapid recovery of patients. In addition, the disability rate of patients in the study group was strongly reduced in this study. It demonstrated that the collaborative multidisciplinary care model could sensibly reduce the disability rate of patients, improve the life quality of patients, and improve the prognosis of patients. In this study, the implementation of a collaborative multidisciplinary care model relied on information sharing and collaborative work among multidisciplinary healthcare professionals, which was similar to Amiri et al.'s [26] research on the application of Internet of Things (IoT) technology in deep learning in bioinformatics and medical informatics. IoT technology can collect patient data in real time and analyze and predict it through deep learning algorithms, providing more accurate decision support for healthcare professionals. Although this study did not directly involve the application of deep learning in the medical field, the successful application of deep learning methods in medical image analysis, disease diagnosis, and other aspects provided a new enlightenment for the collaborative multidisciplinary care model. Through deep learning algorithms, CT or MRI images of patients with cerebral hemorrhage can be automatically analyzed and diagnosed. It can assist medical staff to judge the patient's condition more quickly and accurately, to optimize the emergency plan and nursing strategy [27, 28].

In general, the application of cooperative multidisciplinary nursing mode for comatose patients with ICH could effectively improve the first aid efficiency, improve patients' neurological function, limb function, and daily living ability, reduce the degree of coma and disability rate, and improve patients' prognosis, providing some reference for the nursing and rehabilitation of patients with ICH. However, due to the limited study time, it is not clear whether cooperative multidisciplinary nursing mode can affect the long-term neurological function of patients. In addition, the sample size of this study was small. In our following study, the sample size will be enlarged and the research time will be extended to verify the accuracy of the effects of collaborative multidisciplinary care model.

Limitations: There were some limitations to this study. First of all, the sample size of this study was relatively small. Although the sample size was determined by professional sample size calculation software G-power and PASS, and the efficiency of the statistical test was guaranteed, the small sample size might limit the universality and reliability of the results. Future studies might consider expanding the sample size to include more patients from different hospitals and regions to improve the representativeness and credibility of the results. Second, this study was retrospective and observational, and there were risks of selection and information bias. To mitigate this bias, we used as strict a methodology and criteria as possible in the study design and data analysis process, such as explicit inclusion and exclusion criteria, single interpolation to fill in missing values, and professional statistical software for data analysis. However, the influence of selection and information bias on the results could not be completely excluded. More rigorous study designs such as prospective cohort studies or randomized controlled trials could be considered in future studies to further validate the effect of collaborative multidisciplinary care models on comatose patients with emergency ICH. In addition, the

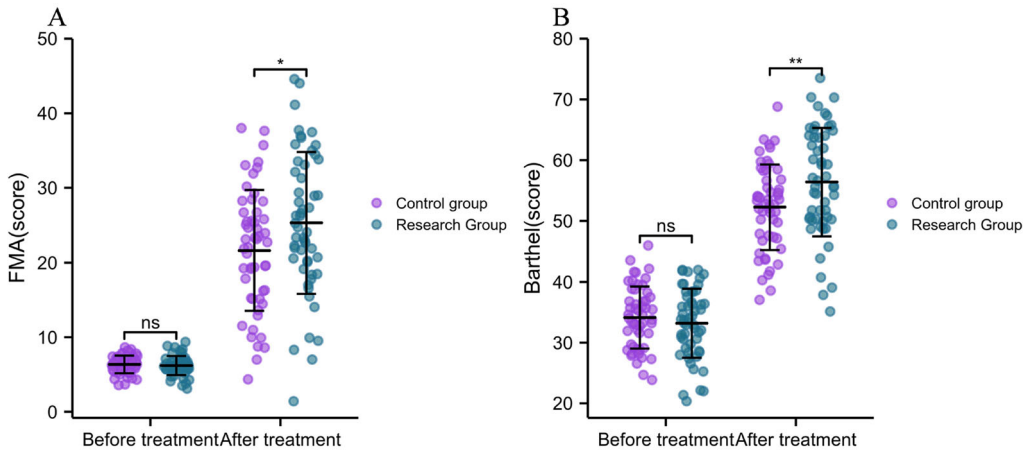

FIGURE 4 | Changes in limb function and daily living ability of patients in the study group and the control group after receiving different nursing models. (A) Comparison of FMA scores. (B) Comparison of Barthel index. ns means $p > 0.05$ compared with the control group; *$p < 0.05$, **$p < 0.01$ compared with the control group.

TABLE 5 | Comparison of complication rate [cases (%)].

Groups	Cases	Cerebral hernia	Hypostatic pneumonia	Upper gastrointestinal bleeding	Incidence
The study group	53	0/53 (0.00)	3/53 (5.66)	4/53 (7.55)	7/53 (13.21)
The control group	53	4/53 (7.55)	6/53 (11.32)	8/53 (15.09)	18/53 (33.96)
χ^2					6.334
p					0.012

TABLE 6 | Comparison of prognosis between two groups [cases (%)].

Groups	Cases	Disability rate	Mortality rate
The study group	53	9/53 (16.98)	5/53 (9.43)
The control group	53	20/53 (37.74)	7/53 (13.21)
χ^2		5.744	0.376
p		0.017	0.540

generalizability of the results of this study in other settings or populations was also worthy of further investigation. This study included only patients in our hospital and was relatively limited in duration and location, so the results might have been influenced by specific Settings and population characteristics. To verify the generality and applicability of the results, future studies might consider validation and comparison across regions, hospitals, and populations to more fully assess the effects and applicability of collaborative multidisciplinary care models. In summary, considering the limitations of the study, further prospective studies and randomized trials would be conducted to confirm the results.

Implications for Practice: The practical significance of this study was not only to verify the positive impact of the collaborative multidisciplinary care model on the prognosis of coma patients with emergency ICH, but also to provide useful reference and inspiration for other medical institutions to implement this model. From the point of view of feasibility, the collaborative multidisciplinary care model emphasized team spirit and patient-centered, which was in line with the development trend of modern medical care. With the continuous progress of medical technology and the transformation of the medical model, multidisciplinary cooperation has become an important means to improve the quality and efficiency of medical service. Therefore, extending this model to other medical institutions, especially to key departments such as emergency departments and neurology departments, has broad application prospects. Concerning cost, although collaborative multidisciplinary care might require some initial investment, including personnel training, equipment acquisition, and process optimization, in the long run, it can significantly improve patient outcomes and quality of life, reduce complications and readmission rates, and thus reduce healthcare costs. Training needs are key to the implementation of a collaborative multidisciplinary care model. Therefore, medical institutions need to strengthen the training and education of healthcare personnel, improve their professionalism and teamwork ability, and ensure that this model can be effectively implemented and continuously improved.

4.1 | Applicability

This study verified the positive impact of the collaborative multidisciplinary care model on the prognosis of coma patients with emergency ICH, and provided useful reference and inspiration for other medical institutions to implement this model. From the point of view of feasibility, the collaborative multidisciplinary care model emphasized team spirit and patient-centered, which was in line with the development trend of modern medical care. With the continuous progress of medical technology and the transformation of medical mode, multidisciplinary cooperation has become an important means to improve the quality and efficiency of medical service. Therefore, this model has broad application prospects, especially in key departments such as the emergency department and neurology department. Future studies might consider verifying the broad applicability of this model in different medical settings and patient populations, and explore its combination and complementarity with other medical models to further improve the quality and efficiency of medical services.

Author Contributions

Yanbin Li: conceptualization, data curation, formal analysis, investigation, methodology, writing – original draft. **Fang Wang:** conceptualization, formal analysis, project administration, resources, software, supervision, validation, visualization, writing – review and editing.

Acknowledgments

The authors have nothing to report.

Ethics Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All procedures performed in the studies were in accordance with the ethical standards of the Ethics Committee of the First Affiliated Hospital of Soochow University (No.2020-LYP-015).

Consent

Informed consent was obtained from all individual participants included in the study. The patients participating in the study all agree to publish the research results.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Transparency Statement

The lead author Fang Wang affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

References

1. R. Garg and J. Biller, "Recent Advances in Spontaneous Intracerebral Hemorrhage," *F1000Research* 8, no. F1000 (March 2019): 302–312.

2. P. Zheng, J. Wang, Y. Ma, J. Xu, and Q. Zhu, "Analysis of the Effect of Cluster Nursing in Postoperative Hypertensive Cerebral Hemorrhage," *Journal of Healthcare Engineering* 2021, no. 1 (December 2021): 3448979.

3. D. Zha, X. Yang, Y. Yang, et al., "The Impact of Multidisciplinary Collaborative Nursing Intervention on Arteriovenous Fistula in Patients Undergoing Hemodialysis," *Clinical Nursing Research* 31, no. 6 (July 2022): 1158–1163.

4. D. Han, D. Wang, J. Yang, and X. Li, "Effect of Multidisciplinary Collaborative Continuous Nursing on the Psychological State and Quality of Life of Patients With Cervical Cancer," *American Journal of Translational Research* 13, no. 6 (June 2021): 6654–6661.

5. W. Ma, L. Zhang, C. Wang, and X. Xu, "Effect of Multidisciplinary Team Collaborative Nursing Model Combined With Mind Mapping Teaching Method on Postoperative Complications and Mental Health of Patients With Advanced Pancreatic Cancer," *Iranian Journal of Public Health* 51, no. 3 (March 2022): 535–543.

6. S. Ahmad, S. Hussain, A. Al Mutairi, M. Kamal, M. U. Rehman, and M. SidAhmed Mustafa, "Improved Estimation of Population Distribution Function Using Twofold Auxiliary Information Under Simple Random Sampling," *Heliyon* 10, no. 2 (January 2024): e24115.

7. J. Dawe, H. Cronshaw, and C. Frerk, "Learning From the Multidisciplinary Team: Advancing Patient Care Through Collaboration," *British Journal of Hospital Medicine* 85, no. 5 (May 2024): 1–4.

8. G. Choby, "Skull Base Tumors: Therapeutic Challenges and Multi-Disciplinary Care," *Cancers* 16, no. 3 (January 2024): 620.

9. S. K. Y. Lam, J. P. C. Chau, S. H. S. Lo, et al., "Evaluation of Cost-Effectiveness of a Virtual Multidisciplinary Stroke Care Clinic for Community-Dwelling Survivors of Stroke," *Journal of the American Heart Association* 13, no. 17 (September 2024): e035367.

10. A. Li, F. D. Atem, A. M. Venkatachalam, A. Barnes, S. E. Stutzman, and D. M. Olson, "Admission Glasgow Coma Scale Score as a Predictor of Outcome in Patients Without Traumatic Brain Injury," *American Journal of Critical Care* 30, no. 5 (September 2021): 350–355.

11. X. Jia, Z. Wang, F. Huang, et al., "A Comparison of the Mini-Mental State Examination (MMSE) With the Montreal Cognitive Assessment (MoCA) for Mild Cognitive Impairment Screening in Chinese Middle-Aged and Older Population: A Cross-Sectional Study," *BMC Psychiatry* 21, no. 1 (October 2021): 485.

12. B. Cheng, J. Chen, A. Königsberg, et al., "Mapping the Deficit Dimension Structure of the National Institutes of Health Stroke Scale," *EBioMedicine* 87 (January 2023): 104425.

13. K. D. Rech, A. P. Salazar, R. R. Marchese, G. Schifino, V. Cimolin, and A. S. Pagnussat, "Fugl-Meyer Assessment Scores Are Related With Kinematic Measures in People With Chronic Hemiparesis After Stroke," *Journal of Stroke and Cerebrovascular Diseases* 29, no. 1 (January 2020): 104463.

14. H. Yang, Y. Chen, J. Wang, H. Wei, Y. Chen, and J. Jin, "Activities of Daily Living Measurement After Ischemic Stroke: Rasch Analysis of the Modified Barthel Index," *Medicine* 100, no. 9 (March 2021): e24926.

15. Y. Chen, S. Chen, J. Chang, J. Wei, M. Feng, and R. Wang, "Perihematomal Edema After Intracerebral Hemorrhage: An Update on Pathogenesis, Risk Factors, and Therapeutic Advances," *Frontiers in Immunology* 12, no. 1 (October 2021): 740632.

16. L. Lihui and Y. Qing, "Optimizing the Prehospital-Hospital Emergency Care Path Application Value in Emergency Treatment of Patients With Cerebral Hemorrhage," *Journal of Healthcare Engineering* 2021, no. 1 (November 2021): 2352208.

17. Y. H. Gu, X. Wang, and S. S. Sun, "Benefits of Multidisciplinary Collaborative Care Team-Based Nursing Services in Treating Pressure

Injury Wounds in Cerebral Infarction Patients," *World Journal of Clinical Cases* 10, no. 1 (January 2022): 43–50.

18. O. Pancorbo, E. Sanjuan, M. T. Rodríguez-Samaniego, et al., "Enhancing Blood Pressure Management Protocol Implementation in Patients With Acute Intracerebral Haemorrhage Through a Nursing-Led Approach: A Retrospective Cohort Study," *Journal of Clinical Nursing* 33, no. 4 (April 2024): 1398–1408.

19. L. Li, J. Chen, M. Hong, M. Hu, T. You, and Q. Luo, "Nursing Intervention and Quality Feedback Guided by Stress System Theory in Neurological Function Recovery and Post-Traumatic Growth of Patients With Acute Primary Cerebral Hemorrhage," *International Journal of Neuroscience* (May 2024): 1–7, https://doi.org/10.1080/00207454.2024.2352035.

20. N. L. Haas, A. Nafday, J. A. Cranford, S. E. Yentz, D. L. Bixby, and B. S. Bassin, "Implementation of a Multidisciplinary Care Pathway via an Emergency Department-ICU to Improve Care of Emergency Department Patients Presenting With Leukostasis," *Critical Care Explorations* 2, no. 2 (February 2020): e0084.

21. S. Aminizadeh, A. Heidari, M. Dehghan, et al., "Opportunities and Challenges of Artificial Intelligence and Distributed Systems to Improve the Quality of Healthcare Service," *Artificial Intelligence in Medicine* 149 (2024): 102779.

22. D. Li, Q. X. Chen, W. Zou, et al., "Acupuncture Promotes Functional Recovery After Cerebral Hemorrhage by Upregulating Neurotrophic Factor Expression," *Neural Regeneration Research* 15, no. 8 (August 2020): 1510–1517.

23. Y. Yang, A. Mu, and Y. Wang, "Early Path Nursing Improves Neurological Function Recovery in Patients With Intracerebral Hemorrhage: Protocol for a Randomized Controlled Trial," *Medicine* 100, no. 1 (January 2021): e24020.

24. L. Zhang, H. Du, and J. Song, "Effect of Holistic Nursing Intervention Combined With Humanized Nursing Intervention on Activities of Daily Living and Limb Movement Ability of Elderly Patients With Cerebral Hemorrhage After Surgery," *Evidence-Based Complementary and Alternative Medicine : eCAM* 2021 (October 2021): 2480551.

25. C. Le, X. Hao, J. Li, et al., "CD200Fc Improves Neurological Function by Protecting the Blood-Brain Barrier After Intracerebral Hemorrhage," *Cell Transplantation* 28, no. 9–10 (Sepetember /Octpober 2019): 1321–1328.

26. Z. Amiri, A. Heidari, N. J. Navimipour, M. Esmaeilpour, and Y. Yazdani, "The Deep Learning Applications in IoT-Based Bio-and Medical Informatics: A Systematic Literature Review," *Neural Computing and Applications* 36 (2024): 5757–5797.

27. Z. Amiri, A. Heidari, M. Zavvar, N. J. Navimipour, and M. Esmaeilpour, "The Applications of Nature-Inspired Algorithms in Internet of Things-Based Healthcare Service: A Systematic Literature Review," *Transactions on Emerging Telecommunications Technologies* 35, no. 6 (2024): e4969.

28. A. Heidari, N. J. Navimipour, S. Zeadally, and V. Chamola, "Everything You Wanted to Know About ChatGPT: Components, Capabilities, Applications, and Opportunities," Internet Technology Letters (May 2024): e530, https://doi.org/10.1002/itl2.530.