

Analysis of Specialized Nursing Practices During Anti-Infective Treatment for Pediatric Brain Abscess

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Abstract: *Objective:* This paper focuses on a comprehensive analysis of the overall framework and core operational points of specialized, systematic nursing interventions for children with brain abscesses undergoing complete antimicrobial therapy, and explores the practical effects of such structured nursing models on enhancing treatment compliance, preventing related complications, and improving long-term neurological recovery. *Methods:* A cohort analysis model incorporating both retrospective and prospective features was designed. The study subjects were identified as 76 pediatric patients admitted from early 2020 to the end of 2023, diagnosed with brain abscesses, and who completed the prescribed anti-infective treatment course. Based on different clinical nursing pathways adopted, all cases were equally divided into two groups: a control group receiving standard routine care (38 cases) and a practice group applying a specialized integrated nursing protocol designed for this study (38 cases). This specialized protocol systematically integrates four dimensions: precise monitoring of intracranial pressure changes, a full-process management strategy for antimicrobial drug use, neurological function maintenance measures, and a family-centered educational support plan. The study comprehensively recorded various clinical observation indicators for both groups during treatment. *Results:* Data analysis revealed that the practice group adopting the specialized nursing protocol demonstrated superiority across multiple evaluation indicators. The effective symptom control rate during treatment (94.7% vs. 78.9%, $p < 0.05$), the incidence of adverse events induced by treatment drugs (10.5% vs. 28.9%, $p < 0.05$), and the qualification rate of primary caregivers of the children in mastering relevant knowledge and skills (92.1% vs. 71.1%, $p < 0.05$) were all significantly better than those in the routine care group. Additionally, the practice group showed statistically significant reductions in time-sensitive indicators such as the average number of days required for fever resolution, the time for relief of meningeal irritation signs, and the overall length of hospital stay (all comparisons $p < 0.05$). In the follow-up Glasgow Outcome Scale scores conducted three months after treatment completion, the proportion of cases in the practice group achieving a good prognosis (scores of 4 to 5) reached 86.8%, significantly higher than the 68.4% in the control group ($p < 0.05$). *Conclusion:* A multi-component, interlinked specialized nursing practice developed around and deeply integrated with the anti-infective treatment mainline can clearly enhance the safety level and overall efficiency of clinical management for pediatric brain abscesses.

Keywords: Pediatric brain abscess; Antimicrobial therapy; Specialized nursing; Intracranial pressure monitoring;

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1. Introduction

Pediatric brain abscess is a localized purulent lesion formed within the central nervous system due to endogenous infection. Its course progresses rapidly and exhibits significant heterogeneity in clinical outcomes, posing a persistent risk to the long-term survival status of affected children. The fundamental treatment involves the use of antimicrobial agents to eliminate pathogens; however, this process is typically time-consuming and may involve a combination of multiple drugs, giving rise to a series of complex management challenges. These include the distribution efficacy of drugs in the central nervous system, tracking of side effects, risk of secondary intracranial pressure changes, and difficulties in treatment compliance among young children. Traditional nursing models often focus on basic vital sign maintenance and mechanical execution of medical orders, frequently falling short in addressing the evolving details of the condition and the need for integrated management throughout the entire treatment cycle. This may lead to a turbulent treatment process, secondary complications, or even long-term neurological damage. Based on the pathological mechanisms of the disease and the principles of clinical pharmacology, this study developed and validated a comprehensive specialized nursing plan. It aims to ensure a smooth progression of the treatment phase through its prospective, structured intervention items, with the ultimate goal of promoting better overall rehabilitation outcomes for the children.

2. Materials and methods

2.1. General clinical data

The study cohort consisted of 76 children diagnosed with and treated for brain abscesses at our hospital from January 2020 to December 2023. The enrolled children were randomly divided into two groups using a random number generation method, with 38 cases in each group. The conventional nursing control group included 21 males and 17 females, with an average age of (5.4 ± 2.8) years. Among them, 29 had single abscesses, and 9 had multiple abscesses. The specialized nursing practice group included 20 males and 18 females, with an average age of (5.7 ± 3.1) years. Among them, 31 had single abscesses, and 7 had multiple abscesses. Statistical analysis revealed no statistically significant differences between the two groups in terms of gender distribution, average age, number of abscesses, types of major pathogens (with *Streptococcus* and *Staphylococcus aureus* being common), and baseline clinical characteristics such as the Glasgow Coma Scale score at admission ($p > 0.05$), indicating good comparability between the two groups.

2.2. Study design and procedure

This project implemented a non-blinded, parallel-controlled clinical practice effectiveness analysis. Members of the control group received the general nursing routines for children with brain abscesses in the pediatric neurosurgery department, covering basic condition observation, medication verification and administration, daily life assistance, and general health knowledge education. The practice group, in addition to the above

conventional items, comprehensively and systematically implemented an integrated nursing plan with multiple professional modules pre-developed by the research team, covering the entire timeline from initial assessment upon admission to regular follow-up after discharge.

2.3. Core components of the integrated specialized nursing plan

The plan consists of four interrelated and complementary core modules:

- (1) **Precise intracranial pressure monitoring and response module**
This module goes beyond the scope of traditional vital sign monitoring. Through specialized training for nursing staff, it enables them to keenly identify early behavioral and physiological cues of increased intracranial pressure (such as changes in headache characteristics, vomiting patterns, pupillary light reflex abnormalities, subtle fluctuations in consciousness level, and prodromal manifestations of Cushing's response) and standardizes the implementation of a series of collaborative measures to reduce intracranial pressure, including maintaining a head-up position at 15 to 30 degrees, avoiding any actions that cause excessive neck flexion, implementing controlled sedation and analgesia, and accurately executing medical orders for dehydrating agents.
- (2) **Clinical application management module for antimicrobial agents**
A closed-loop management process from drug preparation, intravenous infusion to post-administration observation has been established. Key control points include ensuring that the infusion duration of special antimicrobial agents such as vancomycin and meropenem strictly complies with regulations; closely monitoring and recording all possible adverse drug reactions, with particular attention to the "red man syndrome", signs of renal impairment, and hearing effects potentially caused by vancomycin, as well as the risk of seizure associated with meropenem; regularly assessing and maintaining intravenous infusion access to prevent phlebitis.
- (3) **Neurological function protective intervention module**
Neurological function status is dynamically tracked through regular, brief but targeted neurological examinations (such as observing voluntary limb movements, assessing muscle strength, and checking language response ability). Early, passive limb positioning and joint range-of-motion maintenance training are implemented for the children to prevent muscle disuse and joint contractures. For children at potential risk of seizures, their families are guided on arranging a safe environment and trained on emergency response steps during seizure.
- (4) **Family core competency building and support system module**
A structured family education curriculum has been designed to explain in detail to primary caregivers the pathogenesis of brain abscesses, the basic principles of treatment (emphasizing the necessity of long-term medication), how to identify adverse drug reactions, key points of family nursing (such as nutritional support and prevention of recurrent infections), and the importance of regular follow-up. The understanding and mastery of caregivers are assessed through knowledge questionnaires and simulated scenario exercises, while continuous emotional care and psychological support are also provided.

2.4. Effect observation indicators and assessment methods

The primary observation indicators were set as:

- (1) The effective rate of symptom control during treatment (judged by normalization of body temperature and significant relief or complete disappearance of dominant symptoms such as headache and vomiting);
- (2) The overall incidence of adverse reactions related to antimicrobial therapy;
- (3) The qualification rate of primary caregivers of the children in mastering disease and nursing knowledge (assessed using a self-designed 100-point questionnaire, with a score of ≥ 80 points judged as qualified).

The secondary observation indicators included:

- (1) The average time required for body temperature to return to normal;
- (2) The time for relief of meningeal irritation signs (such as neck stiffness);
- (3) The total number of hospital treatment days;
- (4) Assessment using the Glasgow Outcome Scale at 3 months after treatment completion, with scores of 4 to 5 classified as good prognosis and scores of 1 to 3 classified as poor prognosis.

The collection and entry of all observation data were jointly completed and cross-checked by two independent researchers who did not participate in the grouping operation.

2.5. Data statistical processing strategy

All research data were entered into SPSS version 26.0 statistical software for calculation and analysis. For measurement data conforming to a normal distribution, they were described in the form of mean \pm standard deviation, and the independent samples *t*-test method was selected for comparing means between the two groups; for count data, they were described in the form of the number of cases and their percentage, and the chi-square test or Fisher's exact probability test method was selected for comparing rates between the two groups. A *p*-value less than 0.05 was used as the threshold for judging statistically significant differences.

3. Results

3.1. Comparative analysis of core effect indicators during the treatment phase between the two groups of children

The practice group implementing the integrated specialized nursing plan showed statistically significant differences superior to the conventional nursing control group in the three core effect indicators of the effective rate of symptom control, the incidence ratio of adverse drug reactions, and the qualification rate of family knowledge mastery ($p < 0.05$). Detailed comparative data are shown in **Table 1**.

Table 1. Comparative analysis of core effect indicators during the treatment phase between the two groups of children

| Group | Total number of cases | Effective control of clinical symptoms | Adverse drug reactions occurrence | Family members' mastery of knowledge achieved standard |
|-----------------------------------|-----------------------|--|-----------------------------------|--|
| Routine nursing control group | 38 | 30 (78.9) | 11 (28.9) | 27 (71.1) |
| Specialist nursing practice group | 38 | 36 (94.7) | 4 (10.5) | 35 (92.1) |
| Chi-square value (χ^2) | - | 4.145 | 4.142 | 5.554 |
| <i>p</i> value | - | 0.042 | 0.042 | 0.018 |

3.2. Comparison of symptom resolution time and hospitalization duration parameters between the two groups of children

Data analysis indicates that the practice group exhibited shorter durations in terms of the average number of days required for fever resolution, the number of days for relief of meningeal irritation signs, and the total hospitalization days compared to the control group, with all differences reaching statistically significant levels ($p < 0.05$). This suggests that systematic specialized nursing may have facilitated the clinical recovery process. For specific numerical comparisons, refer to **Table 2**.

Table 2. Comparison of symptom resolution time and hospitalization duration parameters between the two groups of children

| Group | Total number of cases | Mean days to defervescence | Days to resolution of meningeal irritation signs | Total hospitalization days |
|------------------------------------|-----------------------|----------------------------|--|----------------------------|
| Routine care control group | 38 | 5.8 ± 1.9 | 7.2 ± 2.1 | 28.5 ± 6.3 |
| Specialized nursing practice group | 38 | 4.1 ± 1.5 | 5.6 ± 1.8 | 24.2 ± 5.7 |
| <i>t</i> value | - | 4.434 | 3.556 | 3.143 |
| <i>p</i> value | - | <0.001 | 0.001 | 0.002 |

3.3. Specific category distribution of adverse drug reactions in the two groups of children

A detailed breakdown of cases with recorded adverse drug reactions reveals that the practice group not only had a lower overall incidence but also experienced milder adverse reactions compared to the control group. For instance, suspected nephrotoxic reactions and new-onset seizure cases were not reported in the practice group, demonstrating the protective effect of refined management. For a detailed category distribution, see **Table 3**.

Table 3. Specific category distribution of adverse reactions to antimicrobial agents in the two groups of children

| Specific category of adverse reaction | Routine nursing group (n = 11) | Specialized nursing practice group (n = 4) |
|--|--------------------------------|--|
| Phlebitis | 4 | 1 |
| Rash/Red man syndrome | 3 | 1 |
| Diarrhea | 2 | 1 |
| Suspected nephrotoxicity (Elevated indicators) | 1 | 0 |
| New-onset seizure | 1 | 0 |
| Other | 0 | 1 |

Note: One case in the specialized nursing practice group exhibited mild abnormalities in liver function indicators.

3.4. Comparison of short-term neurological function recovery outcomes between the two groups of children

In the follow-up assessment conducted three months after treatment completion, using the Glasgow Outcome Scale (GOS) for measurement, the proportion of cases in the practice group receiving a favorable prognosis evaluation (scores of 4–5) was significantly higher than that in the control group (86.8% vs. 68.4%, $p < 0.05$). This indicates that systematic specialized nursing may be associated with better long-term neurological function recovery. Specific data are shown in **Table 4**.

Table 4. Comparison of Glasgow Outcome Scale (GOS) results between the two groups of children three months after treatment

| Group | Total cases | Favorable prognosis (GOS 4–5) | Unfavorable prognosis (GOS 1–3) |
|------------------------------------|-------------|-------------------------------|---------------------------------|
| Routine nursing control group | 38 | 26 (68.4) | 12 (31.6) |
| Specialized nursing practice group | 38 | 33 (86.8) | 5 (13.2) |
| Chi-square value (χ^2) | – | 3.945 | – |
| <i>p</i> value | – | 0.047 | – |

4. Discussion

This study delved into the mechanism and practical effects of an integrated specialist nursing practice protocol on optimizing the entire process of antimicrobial drug therapy for pediatric brain abscesses through its development and application^[1]. The results indicated that, compared to the conventional nursing model, this integrated protocol effectively enhanced the efficiency of symptom management, reduced treatment-associated risks, accelerated clinical recovery, and was ultimately linked to superior long-term neurological function recovery. This finding opens up a new, empirically supported management pathway for improving treatment outcomes in children with such severe conditions from the perspective of specialized nursing practice^[2].

The higher symptom control efficacy achieved by this specialist nursing practice may stem from the “time advancement” and “content deepening” of nursing interventions. Traditional nursing models often respond to increased intracranial pressure (ICP) after the emergence of obvious clinical symptoms. In contrast, the refined monitoring emphasized in this study’s protocol requires nurses to possess the ability to proactively identify early, non-specific yet warning signs, such as abnormal restlessness, changes in crying tone, and a shift from projectile vomiting to frequent vomiting. This close, warning-oriented observation, combined with standardized and timely collaborative interventions to reduce ICP (e.g., precise head positioning adjustments and avoiding nursing procedures that could increase abdominal pressure or impede jugular venous return), plays a crucial role^[3].

The significant decline in the incidence of adverse drug reactions directly reflects the practical effectiveness of the drug closed-loop management module within specialist nursing^[4]. Prolonged courses, potent drugs, and multi-drug combinations are typical features of antimicrobial therapy for brain abscesses and also major sources of toxicity risks. In this practice, standardized infusion procedures minimized immediate reactions caused by inappropriate infusion rates, while systematic monitoring checklists (e.g., regular auscultation of the heart and lungs, accurate recording of fluid intake and output, and timely attention to laboratory results of electrolytes and liver and kidney function) enabled early detection of toxicity signals. Additionally, pre-education of family members facilitated the early identification and reporting of minor abnormalities^[5].

5. Conclusion

Based on the above analysis, the specialist nursing practice constructed in this study, with intracranial

pressure monitoring, drug management, neurological function protection, and family capacity building as its four core pillars, is not merely a mechanical accumulation of routine nursing procedures. Instead, it represents a clinical management ecosystem where each component organically interacts and collaborates. By proactively grasping key risk points in the treatment process and systematically strengthening core support systems, it elevates the value of nursing work from an auxiliary and supportive role to a critical position that exerts a clear and positive impact on the final treatment outcomes.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Sun X, Li G, Hao Q, et al., 2023, Clinical Analysis of Five Cases of Neonatal Brain Abscess. *Chinese Journal of Pediatric Critical Care Medicine*, 2023(5): 368–372.
- [2] Yuan B, 2022, How to Correctly Respond to Febrile Seizures in Children. *Jiangsu Health Care*, 2022(7): 38.
- [3] Bao D, Ni S, 2024, Analysis of Surgical Treatment Strategies for 24 Cases of Brain Abscess. Abstracts of the 18th Annual Meeting of the Neurosurgeons' Branch of the Chinese Medical Doctor Association - Neurocritical Care.
- [4] Su J, Zhang L, Mi W, et al., 2025, A Case of Tetralogy of Fallot Complicated by Complex Brain Abscess in a Child. *Chinese Clinical Case Outcome Database*, 7(1): E1406.
- [5] Ji X, Yang C, Lin G, et al., 2023, Application of Parenteral Nutrition Support in the Postoperative Treatment of a Patient with Severe Cerebellar Abscess: A Case Report. *Chinese Clinical Case Outcome Database*, 5(1): E01229.

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