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*Original Article*

# Application of an eight-step process and four-track cross check quality control in cerebral glioma surgery

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**Abstract:** Objective: This study was designed to explore the effects of an eight-step process, four-track cross check quality control, and nursing intervention on the improvement of cancer-related fatigue (CRF), adverse motions, and quality of life of patients undergoing cerebral glioma surgery. Method: A retrospective analysis was conducted on the clinical data of 113 patients with cerebral glioma surgery in our hospital from December 2015 to February 2018. Based on the nursing methods, the patients were divided Group A and Group B. Group A received conventional postoperative care, while Group B received eight-step process, four-track cross check quality control, and nursing intervention. The recovery indices, CRF scores, self-rating anxiety scale (SAS), self-rating depression scale (SDS), changes in quality of life scores, complications, nursing deficiencies and clinical efficacy were compared between the two groups. Results: Patients in Group B had shorter time than those in Group A in terms of getting out of bed, removal of the urinary catheter, first meal and length of hospital stay ($P$<0.05). Compared with Group A, Group B showed better scores in cognitive fatigue, emotional fatigue and physical fatigue after intervention ($P$<0.05). SAS and SDS scores in Group B were lower after intervention than those in Group A ($P$<0.05). Group B indicated better quality of life scores in the five functional areas of society, emotion, cognition, role, and body after intervention than those in Group A ($P$<0.05). The incidence rate of complications was 7.02% in Group B, lower than 25.00% in Group A ($P$<0.05). The incidence rate of nursing deficiencies was 1.75% in Group B, lower than 16.07% in Group A ($P$<0.05). The total effective rate was 94.74% in Group B, which was higher than 73.21% in Group A, indicating significant difference ($P$<0.05). Conclusion: The eight-step process, four-track cross check quality control, and nursing intervention can improve treatment for CRF, adverse emotions, and quality of life and reduce the incidence rates of complications and nursing deficiencies in patients undergoing cerebral glioma surgery.

**Keywords:** Cerebral glioma surgery, eight-step process, four-track cross check quality control, cancer-related fatigue, adverse emotions, quality of life

## Introduction

Cerebral glioma clinically refers to primary malignant brain tumors caused by canceration of glial cells in the brain and spinal cord [1]. Of all intracranial tumors, gliomas, which are characterized by having a high incidence rate, high mortality, low cure rate and high recurrence rate, account for 35.2%-61.0% [2]. At present, the specific cause of the disease has not yet been clinically determined. Through the analyses of most researchers, it is believed that glioma is directly related to the occurrence of the tumor itself, but the main influencing factors include electromagnetic radiation, chemistry, changes in living environment and, viral infection, *etc*. [3, 4].

Generally, cerebral glioma cells usually have infiltrative and diversified growth patterns. Surgical resection of the tumor can prolong the survival time of patients [5]. Gliomas not only threaten the life of patients, but also increase their psychological burden, causing cancer-related fatigue (CRF) and other symptoms. This is not conducive to the improvement of the patients' quality of life or therapeutic effects [6, 7]. Meanwhile, surgical trauma and perioperative stress reactions may further damage the patients' physical and mental health over time, affecting the therapeutic effects and increasing the incidence rate of postoperative complications. Therefore, it is necessary to provide a more scientific and proper nursing intervention for patients undergoing glioma surgery [8, 9].

Previously, a conventional postoperative nursing intervention was usually performed, *i.e.* the changes in the patients' vital signs and conditions were closely observed after surgery, and nursing intervention was provided according to the actual situation of patients [10]. With the changes of modern nursing modes, the old nursing mode has been unable to meet the ever-increasing needs of patients [11]. According to previous clinical experience, the content of postoperative nursing care for patients after cerebral glioma surgery was summarized, and an eight-step nursing process was developed to effectively guide nursing staff to implement a standardized and scientific nursing intervention in order to reduce nursing deficiencies [12]. Meanwhile, a four-track cross check quality control was performed to strengthen patient management, help nursing staff consolidate their professional knowledge, paying attention to nursing details, and improve the quality of nursing [13, 14]. In view of this, an eight-step process and four-track cross check quality control was adopted during postoperative care for cerebral glioma patients, exhibiting innovation and feasibility.

## Materials and methods

### *Materials*

A retrospective analysis was conducted on the clinical data of 113 patients who underwent cerebral glioma surgery in our hospital from December 2015 to February 2018. Based on the nursing methods, the patients were divided into Group A (n=56) and Group B (n=57). Group A received conventional postoperative care, while Group B received an eight-step process, four-track cross check quality control, and nursing intervention. (1) Inclusion criteria: patients who were diagnosed with cerebral glioma by cranial MRI or CT examination; patients with good communication skills; patients with a clear consciousness after surgery and effective cooperation for multiple evaluations and nursing. This study was conducted with the approval of the Medical Ethics Committee. All patients signed the written informed consent. (2) Exclusion criteria: midway withdrawal; patients having cognitive dysfunction or mental disorders; patients with a history of cranialcerebral trauma surgery; patients with basic diseases (*e.g.*, acute infection diseases); patients accompanied by other types of tumors.

### *Methods*

Group A received conventional postoperative care, *i.e.* the changes in patients' vital signs were closely monitored, drugs were given strictly according to the doctor's advice, any questions raised by patients and their families were patiently and carefully answered, health education was strengthened, and psychological counseling was offered to patients if necessary to provide psychological support.

Group B received an eight-step process, four-track cross check quality control, and nursing intervention after surgery.

*Eight-step process for postoperative nursing care:* A dedicated nursing team was established. Based on the recent relevant literature and the best current situations of teaching and research, an eight-step process for postoperative nursing care was tailor-made for patients. All members of the team received unified training, and only those who went through an examination were allowed to offer nursing care. The eight-step process for postoperative nursing care included: (1) When the operating room nurses sent the patients to the ward, the nurse on duty had a comprehensive understanding of the surgical conditions of the patients, they would conduct the staff's hand-over procedures patiently and carefully and record the relevant information in detail. Upon completion of hand-over procedures, both nursing teams would sign for confirmation. (2) After the patient was admitted to the ward, the nurse assisted the patient to take the most comfortable position on the uninjured arm, and elevate the bed's head by 15-30° after the patient had stable blood pressure and a clear awareness. In order to avoid complications (e.g., pressure sore), the patient was assisted to turn over 24 h after surgery, instructed to avoid coughing as much as possible, and informed of the nursing operation process, significance and time, so as to improve the patient's cooperation to the greatest extent. (3) ECG monitoring was performed on the patient, the changes in consciousness, pupil and muscle strength were carefully observed, the doctor's advice was strictly followed, and symptomatic and supportive measures, including anti-infection, oxygen inhalation, dehydration, *etc.*, were taken. If increased intracranial pressure was identified the nurse contacted the physician on duty immediately and made

detailed records. (4) The wound of the patient was regularly observed for exudation or bleeding, the dressing was replaced and it was kept dry. When fixing the drainage tube after surgery, it was kept at the same level with the head, and the nature and color of the drainage fluid were carefully observed. The drainage bag was clamped when the nurse was not present or the patient was being transported, and the urinary catheter was removed after the patient was awake from anesthesia for 6-24 h. (5) Lung nursing intervention was strengthened. In order to avoid hypoxia or lung infection, sputum suction, back tapping and turning over were performed. (6) The patient was given 2000ml of water on the 1st day after surgery, and the amount of water was gradually reduced from the 2nd day after surgery. On the 3rd day after surgery, the infusion was stopped and the patient was allowed to eat. The patient was given 250 ml of nutrient solution orally 6 h after surgery. A fluid diet was allowed to be taken on the 1st day after surgery, and a normal diet was allowed to be taken on the 2nd day after surgery. (7) When the patient was fully awake from general anesthesia, ankle flexion exercise and lower limb extension and flexion exercise could be performed on the bed. If conditions permitted, the patient could attempt to leave the bed on the 1st day after surgery. The rehabilitation technician assisted the patient in performing limb function training for dyskinesia, corrected any improper movement of the patient during the training, and actively adopted safety protection measures. (8) The nursing staff of each shift was required to improve the shift change work, make relevant records, cooperate with each other efficiently, and provide high-quality nursing services for the patients.

*Four-track cross check quality control:* During the implementation of the eight-step nursing process, a four-track cross check quality control was adopted to strengthen the nursing quality management, and a nursing deficiency quality control table was scientifically and properly designed based on the inspection of management personnel, a shift review was conducted, with a mutual inspection of shift personnel and a self-inspection of nursing personnel. The main content of this tracking table included ward management, surgical incision care, condition monitoring, dietary care, drainage tube care, urination care, drug administration care, respiratory tract care and posture care. If any of these items were not completed, it would be regarded as a nursing deficiency and remedial measures would be taken The management personnel were required to report weekly statistics on the occurrence of nursing deficiencies, summarize and analyze the results at the panel discussion, and formulate targeted improvement measures, so as to continuously improve the effects of the nursing management.

*Observation indices*

Postoperative recovery indices: including time of first leaving the bed, removal of urinary catheter, first meal and length of hospital stay.

CRF scores [15]: Before and after intervention, the CRF scale was used to evaluate the cancer-related fatigue of the patients in the two groups, including cognitive fatigue, emotional fatigue and physical fatigue. There were 15 evaluation items in total. The total score was 60 points. A higher score indicated more serious cancer-related fatigue.

Mental state [16]: Before and after intervention, self-rating anxiety scale (SAS) and self-rating depression Scale (SDS) were used to evaluate the anxiety and depression of the patients in both groups, respectively. There were 20 evaluation items in both scales, which were evaluated using the Likert Grade 4 scoring method. The critical value of the SAS scale was 50 points and that of SDS scale was 53 points. The degree of anxiety and depression was proportional to the score.

Quality of life [17]: Before and after intervention, EORTC QLQ-C30 (questionnaire designed by the European Organization for Research and Treatment of Cancer) was used to evaluate the quality of life of patients in both groups, including five functional areas of society (2 items), emotion (4 items), cognition (2 items), role (2 items) and body (5 items). All items were evaluated using a scoring method of 1-4 points, with a total score of 15-60 points. The quality of life was directly proportional to the score.

Complications: including deep vein thrombosis, secondary epilepsy, hyperpyrexia, intracranial hemorrhage and pulmonary infection were recorded.

**Table 1.** Comparison of general data between the two groups [n (%)]/(mean ± SD)

| | | Group A (n=56) | Group B (n=57) | $t/X^2$ | *P* |
|---|---|---|---|---|---|
| Gender (cases) | Male | 39 (69.64) | 42 (73.68) | 0.227 | 0.634 |
| | Female | 17 (30.36) | 15 (26.32) | | |
| Age (years) | | 47.85±6.32 | 47.89±6.29 | | |
| Lesion location (cases) | | | | | |
| Occipital lobe | | 5 (8.93) | 7 (12.28) | 0.025 | 0.968 |
| Temporal lobe | | 8 (14.29) | 7 (12.28) | | |
| Parietal Lobe | | 13 (23.21) | 15 (26.32) | | |
| Frontal lobe | | 30 (53.57) | 28 (49.12) | | |
| Clinical staging (cases) | | | | | |
| Phase I | | 12 (21.43) | 11 (19.30) | 0.128 | 0.638 |
| Phase II | | 23 (41.07) | 25 (43.86) | | |
| Phase III | | 13 (23.21) | 12 (21.05) | | |
| Phase IV | | 8 (14.29) | 9 (15.79) | | |

The incidence rates of nursing deficiencies were compared between the two groups.

Efficacy evaluation criteria: If the lesion was reduced by less than 50%, and the symptoms were not significantly improved, it was graded as ineffective; if the lesion was reduced by more than 50% and the clinical symptoms were significantly improved, it was graded as effective; if postoperative MRI enhanced examination showed that the glioma was completely removed and the clinical symptoms basically disappeared, it was graded as markedly effective. Total effective rate = markedly effective + effective.

*Statistical analysis*

The data were analyzed using SPSS 22.0. The measurement data were expressed as mean ± standard deviation (mean ± SD). *t* test was performed for the data conforming to a normal distribution, and Mann-Whitney U test was conducted for those not conforming to a normal distribution. The counting data were expressed using [n (%)]. Chi-squared test was conducted for the comparison of counting data between the two groups. $P<0.05$ indicated statistical significance.

## Results

*Comparison of general data between the two groups*

There were 39 males and 17 females in Group A and 42 males and 15 females in Group B, and the comparison suggested no statistical significance ($P>0.05$). There was no significant difference in age, lesion location and clinical staging between the two groups ($P>0.05$) (**Table 1**).

*Comparison of postoperative recovery indices between the two groups*

The patients in Group B had shorter time than those in Group A in terms of first leaving the bed (1.85±0.28 d), removal of the urinary catheter (16.02±1.28 h), first meal (10.02±0.89 h) and length of hospital stay (8.12±0.18 d), demonstrating a significant difference ($P<0.05$) (**Table 2**).

*Comparison of CRF scores of the two groups before and after intervention*

There was no significant difference in scores of cognitive fatigue, emotional fatigue and physical fatigue of the two groups before intervention ($P>0.05$). Compared with before intervention, the scores of cognitive fatigue, emotional fatigue and physical fatigue in both groups decreased after intervention, exhibiting a significant difference ($P<0.05$). After intervention, Group B indicated lower scores of cognitive fatigue, emotional fatigue and physical fatigue than Group A, showing a significant difference ($P<0.05$) (**Figure 1**).

*Comparison of SAS and SDS scores of the two groups before and after intervention*

There was no significant difference in SAS and SDS scores between the two groups before

**Table 2.** Comparison of postoperative recovery indices between the two group (mean ± SD)

| Group | First leaving bed (d) | Removal of urinary catheter (h) | First eating (h) | Length of hospital stay (d) |
|---|---|---|---|---|
| Group A (n=56) | 2.56±0.52 | 19.98±5.12 | 13.56±1.28 | 9.98±0.68 |
| Group B (n=57) | 1.85±0.28* | 16.02±1.28* | 10.02±0.89* | 8.12±0.18* |
| *T* | 9.059 | 5.662 | 17.094 | 19.953 |
| *P* | 0.000 | 0.000 | 0.000 | 0.000 |

Note: * indicates the comparison with Group A, *P*<0.05.

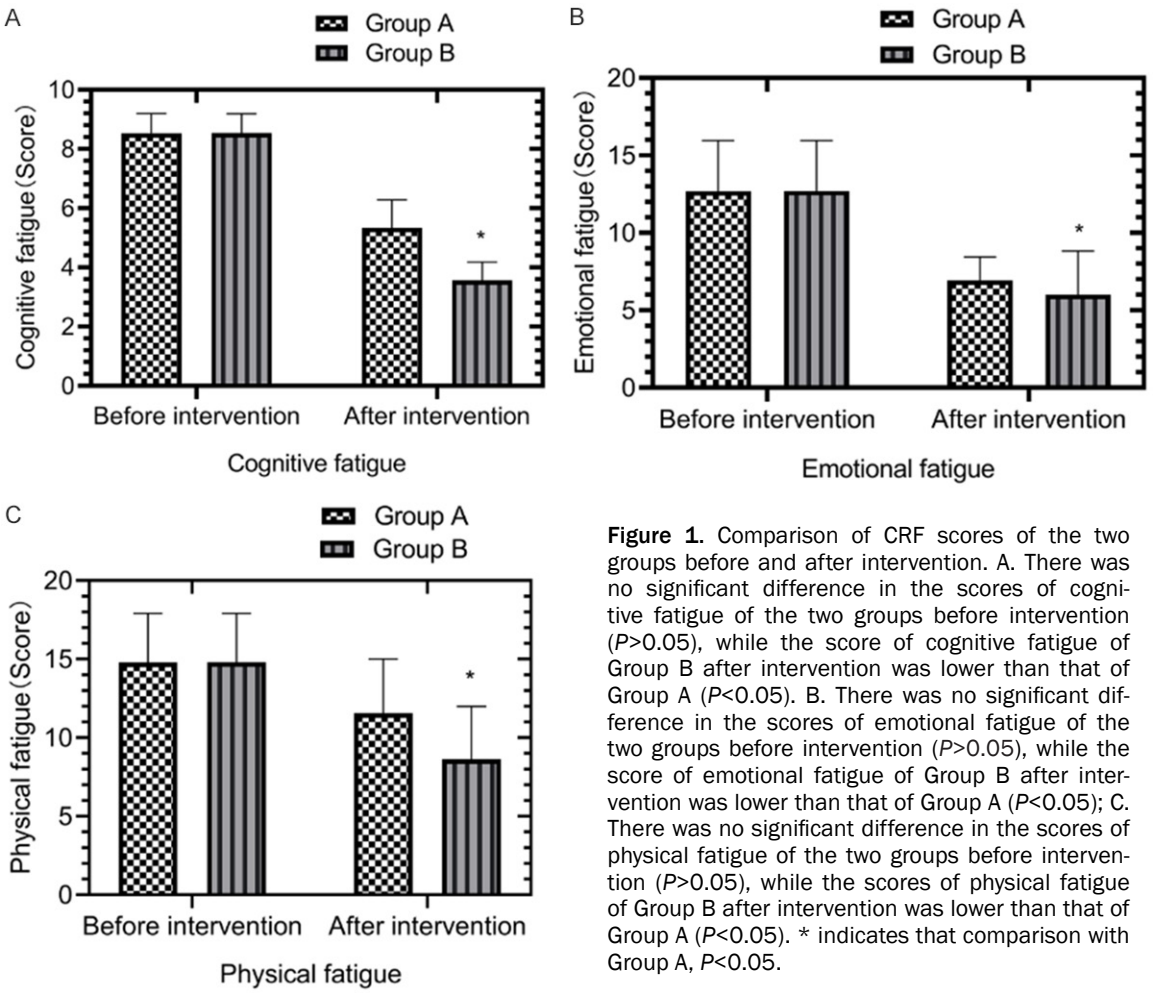


**Figure 1.** Comparison of CRF scores of the two groups before and after intervention. A. There was no significant difference in the scores of cognitive fatigue of the two groups before intervention (*P*>0.05), while the score of cognitive fatigue of Group B after intervention was lower than that of Group A (*P*<0.05). B. There was no significant difference in the scores of emotional fatigue of the two groups before intervention (*P*>0.05), while the score of emotional fatigue of Group B after intervention was lower than that of Group A (*P*<0.05); C. There was no significant difference in the scores of physical fatigue of the two groups before intervention (*P*>0.05), while the scores of physical fatigue of Group B after intervention was lower than that of Group A (*P*<0.05). * indicates that comparison with Group A, *P*<0.05.

intervention (*P*>0.05). Compared with before intervention, SAS and SDS scores of the two groups decreased after intervention, indicating a significant difference (*P*<0.05). SAS and SDS scores of Group B were lower than those of Group A after intervention, exhibiting a significant difference (*P*<0.05) (**Figure 2**).

*Comparison of quality of life scores of the two groups before and after intervention*

There was no significant difference in quality of life scores between the two groups in the five functional areas of society, emotion, cognition, role, and body before intervention (*P*>0.05). Compared with before intervention, the quality of life scores of the two groups in the five functional areas of society, emotion, cognition, role, and body decreased after intervention, indicating a significant difference (*P*<0.05). The scores of quality of life in the five functional areas of society, emotion, cognition, role, and body of Group B were lower than those of Group A after intervention, showing a significant difference (*P*<0.05) (**Figure 3**).

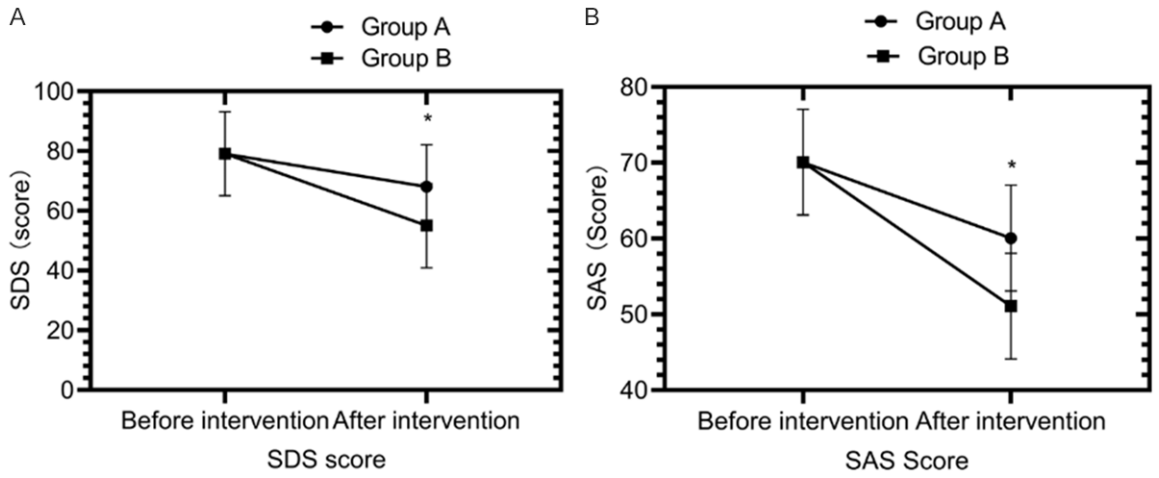


**Figure 2.** Comparison of SAS and SDS scores of the two groups before and after intervention. A. There was no significant difference in the SDS scores of the two groups before intervention ($P>0.05$), while the SDS score of Group B after intervention was lower than that of Group A ($P<0.05$); B. There was no significant difference in the SAS scores of the two groups before intervention ($P>0.05$), while the SAS score of Group B after intervention was lower than that of Group A ($P<0.05$). * indicates the comparison with Group A, $P<0.05$.

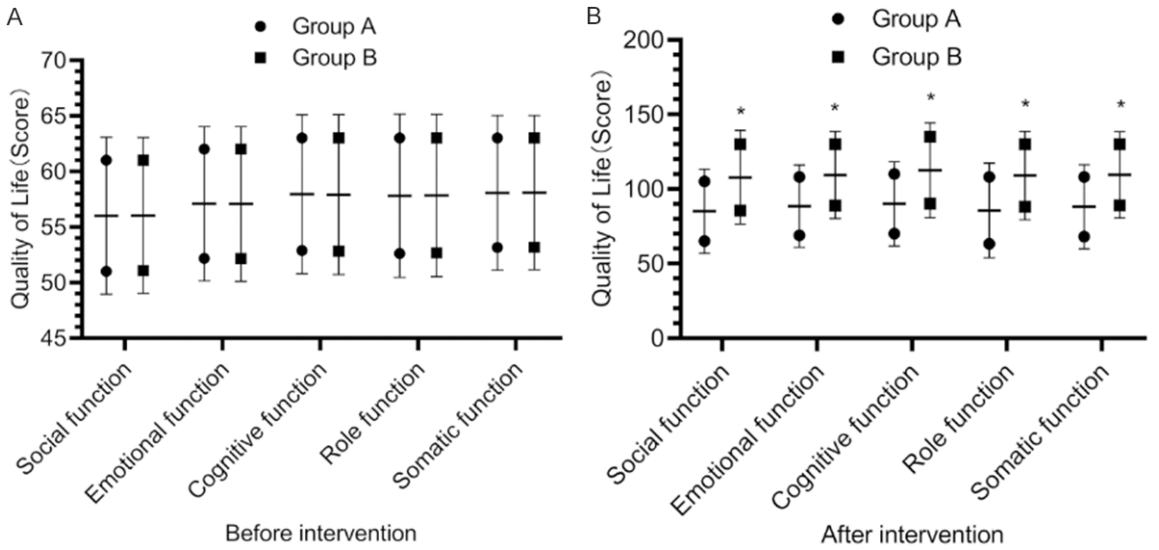


**Figure 3.** Comparison of quality of life scores of the two groups before and after intervention. A. There was no significant difference in the quality of life scores of the two groups in the five functional areas of society, emotion, cognition, role, and body before intervention ($P>0.05$); B. The quality of life scores of Group B in the five functional areas of society, emotion, cognition, role, and body were higher than those of Group A ($P<0.05$). * indicates the comparison with Group A, $P<0.05$.

*Comparison of complications between the two groups*

There were 1 case of deep vein thrombosis, 1 case of secondary epilepsy, 1 case of hyperpyrexia, 0 cases of intracranial hemorrhage, and 1 case of pulmonary infection in Group B; while there were 3 cases of deep vein thrombosis, 2 cases of secondary epilepsy, 3 cases of hyperpyrexia, 3 cases of intracranial hemorrhage and 3 cases of pulmonary infection in Group A. The incidence rate of complications was 7.02% in Group B, which was lower than 25.00% in Group A, demonstrating a significant difference ($P<0.05$) (**Table 3**).

**Table 3.** Comparison of complications between the two groups [n (%)]

| Group | Number of cases | Deep vein thrombosis | Secondary epilepsy | hyperpyrexia | Intracranial hemorrhage | Pulmonary infection | Total occurrence |
|---|---|---|---|---|---|---|---|
| Group A | 56 | 3 (5.36) | 2 (3.57) | 3 (5.36) | 3 (5.36) | 3 (5.36) | 14 (25.00) |
| Group B | 57 | 1 (1.75) | 1 (1.75) | 1 (1.75) | 0 (0.00) | 1 (1.75) | 4 (7.02)* |
| $X^2$ | | | | | | | 6.821 |
| *P* | | | | | | | 0.009 |

Note: * indicates the comparison with Group A, $P<0.05$.

**Table 4.** Comparison of nursing deficiencies between the two groups [n (%)]

| Group | Number of cases | Incidence rate of nursing deficiencies |
|---|---|---|
| Group A | 56 | 9 (16.07) |
| Group B | 57 | 1 (1.75)* |
| $X^2$ | | 7.178 |
| *P* | | 0.007 |

Note: * indicates the comparison with Group A, $P<0.05$.

*Comparison of the occurrence of nursing deficiencies between the two groups*

During the nursing care, there was a total of 1 case of nursing deficiencies in Group B, which was lower than 9 cases reported in Group A. The incidence rate of nursing deficiencies was 1.75% in Group B, which was lower than 16.07% in Group A, exhibiting a significant difference ($P<0.05$) (**Table 4**).

*Comparison of the efficacy between the two groups*

The total effective rate was 94.74% in Group B, higher than 73.21% in Group A, indicating significant difference ($P<0.05$) (**Table 5**).

## Discussion

There is a high risk for surgical treatment of cerebral glioma, and multiple factors, such as the stress response, an over-tight bandage and intraoperative traction, may cause local cerebral tissue edema and multiple serious complications, seriously threatening the life and health of patients [18, 19]. In addition, there are many postoperative nursing issues that are required for cerebral glioma patients, with a high requirement for detail. The conventional experiential nursing mode can no longer meet the needs for postoperative nursing, and is therefore not conducive to promoting good postoperative rehabilitation of patients, and may lead to nurse-patient disputes due to nursing deficiencies [20]. Therefore, it is of great importance to explore a more scientific and proper post-operative nursing mode for interventions in patients undergoing cerebral glioma surgery.

Although nursing quality is gaining attention in China over the years, the question of how to ensure a proper and standardized nursing process remains a very important issue [21]. In this study, the previous post-operative nursing experience for cerebral glioma patients was summarized, and based on real time, an eight-step nursing process was established, and on this basis, a four-track cross check quality control was adopted to provide the best post-operative nursing services for cerebral glioma patients. The results revealed that treatment results in Group B were superior to Group A regarding the postoperative recovery indices and quality of life; while Group A had higher rates of incidence rates of complications and nursing vacancy rate compared to Group B. Additionally, the eight-step process, four-track cross check quality control, and nursing interventions adopted for glioma surgery patients was conducive to promoting better postoperative recovery of patients, improving postoperative quality of life, and reducing the incidence rates of complications and nursing vacancies. The mechanisms were explored, and with the eight-step process, the training and assessment of nursing staff were strengthened, and the postoperative nursing process was sorted out, so as to improve the process and help make it more clear [22]. Second, with this nursing mode, the nurses can easily grasp the key points of nursing and effectively perform nursing work, such as, closely monitoring the changes in patients' vital signs, observing the occurrence of complications, strengthening catheter management and lung health management,

**Table 5.** Comparison of the efficacy between the two groups [n (%)]

| Group | Case | Markedly effective | Effective | Ineffective | Total effective rate |
|---|---|---|---|---|---|
| Group A | 56 | 23 (41.07) | 18 (32.14) | 15 (26.79) | 41 (73.21) |
| Group B | 57 | 32 (56.14) | 22 (38.60) | 3 (5.26) | 54 (94.74)* |
| $X^2$ | | | | | 9.771 |
| *P* | | | | | 0.002 |

Note: * indicates the comparison with Group A, $P<0.05$.

changing dressings in a timely manner so that they are kept dry, and helping patients to get out of bed and eat as soon as possible [23]. Meanwhile, the adoption of the four-track cross check quality control to comprehensively monitor all types of postoperative nursing work can promote nursing work, reduce the occurrence rate of nursing deficiencies, and help identify the deficiencies in the nursing process through the multi-level cross check quality control so that prompt correctional measures can be taken [24]. Early ambulation after surgery can positively reduce the incidences of postoperative deep vein thrombosis and pulmonary infection, and early eating after surgery is conducive to promoting gastrointestinal peristalsis, thus protecting the intestinal mucosal barrier function, lowering the incidence rate of postoperative complications, and improving the quality of life of patients.

Clinical studies have shown that most cerebral glioma patients exhibit different degrees of depression and anxiety after surgery, and clinicians paid little attention to this [25]. In this study, the SAS and SDS scores of patients undergoing cerebral glioma surgery in the two groups were generally high, suggesting that the degree of anxiety and depression after surgery was very serious. After nursing intervention, the SAS and SDS scores of Group B were significantly lower than those of Group A, indicating that the eight-step process, four-track cross check quality control, and nursing intervention adopted for patients undergoing cerebral glioma surgery could effectively reduce adverse emotions and improve adverse psychological states. The mechanisms were explored, and regarding the eight-step process and four-track cross check quality control, nursing staff paid more attention to nursing details, including patients' physiological health and the influences of psychological factors on postoperative rehabilitation effects [26]. After surgery, the nursing staff patiently informed the patient of the nursing operation process, significance and timeliness, so as to improve the patient's nursing cooperation to the greatest extent, eliminate all kinds of doubts, alleviate the psychological pressure, and improve treatment enthusiasm. Cancer-related fatigue, a common symptom of patients with malignant tumors is usually caused by adverse drug reactions, surgical complications, pain and psychological factors, it is a feeling of energy failure (e.g., persistent cognition, emotion, physiology, *etc*.) and subjective fatigue caused by anti-tumor therapies or tumors, and it may affect the patients' social function and daily life, including social, psychological and physiological aspects of subjective experience [27, 28]. In this study, the postoperative cancer-related fatigue scores of the patients in the two groups were generally higher. However, after intervention, the cancer-related fatigue score of group B was markedly lower than that of group A, suggesting that the eight-step process and four-track cross check quality control positively reduced the cancer-related fatigue of patients undergoing cerebral glioma surgery. By exploring its mechanisms, it was found that the influencing factors of cancer-related fatigue included adverse drug reactions, surgical complications, pain and adverse psychology. After intervention, there was a reduced incidence rate of complications and improved psychological state and quality of life of patients in Group B, which were all conducive to improving the patients' abilities to treat disease and their subjective initiatives. Therefore, the tolerance of cancer-related fatigue was elevated, and multiple symptoms were improved accordingly.

In summary, the eight-step process, four-track cross check quality control, and nursing intervention are conducive to improving cancer-related fatigue, adverse emotions, quality of life, and the incidence rates of complications and nursing deficiencies in patients undergoing cerebral glioma surgery.

Although this study has achieved some results, there are limitations of a small sample size. Therefore, a larger sample size, a longer duration and a more comprehensive research and analysis are required in future study.

## Disclosure of conflict of interest

None.

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