

Article

Tidal model nursing and its association with reduced depressive symptoms and improved self-efficacy after stroke: a clinical comparative study

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Abstract: Post-stroke depression is highly prevalent among patients with primary malignant brain tumors/gliomas complicated by stroke and may substantially hinder psychological adaptation and rehabilitation engagement. This prospective, randomized, parallel-group clinical study examined the effects of Tidal model-based nursing on depressive symptoms and rehabilitation self-efficacy in 60 patients with malignant tumors complicated by stroke. Participants were assigned to either structured Tidal model nursing or routine care for 14 days. Depressive symptoms were assessed using the Hamilton Depression Scale, and self-efficacy was measured using the Stroke Self-Efficacy Questionnaire at baseline and day 14. After adjustment for baseline severity, the intervention group demonstrated significantly lower depressive symptoms at day 14 compared with controls (adjusted mean difference -13.18 ; 95% CI -16.18 to -10.18 ; $p < 0.001$), with a large effect size (Cohen's $d = -1.87$). Self-efficacy improved significantly in the intervention group (adjusted mean difference $+16.17$; 95% CI 11.73 to 20.62 ; $p < 0.001$; Cohen's $d = 1.64$). Clinical remission occurred in 40% of the intervention group and none of the control group. Change in self-efficacy was significantly correlated with depressive symptom reduction ($r = -0.61$, $p < 0.001$) and partially mediated treatment effects. Recurrence at 12 months was lower in the intervention group, although not statistically significant. These preliminary findings from a single-center study suggest that structured, empowerment-based psychosocial nursing may substantially improve mood and perceived agency in patients with primary malignant brain tumors complicated by stroke. The generalizability of these findings to other cancer types requires further investigation.

Keywords: tidal model nursing; malignant tumor; post-stroke depression; self-efficacy; psychosocial rehabilitation; oncology

1. Introduction

1.1. Post-stroke depression as a biopsychosocial complication

Post-stroke depression represents one of the most common and clinically consequential neuropsychiatric complications following cerebrovascular events. Its prevalence has been estimated to range between 20% and 40% in general stroke populations, with even higher rates observed in medically complex or neurologically compromised cohorts. However, when stroke occurs in the context of malignant tumors, the psychological burden may be significantly amplified. Patients with primary brain malignancies, including gliomas and other aggressive intracranial neoplasms, already confront substantial existential distress, uncertainty regarding prognosis, cognitive impairment, and functional decline [1,2]. The superimposition of a cerebrovascular insult introduces an additional neurological and psychosocial layer of vulnerability, creating a compounded risk for depressive symptomatology [3–6].

From a biopsychosocial perspective, post-stroke depression cannot be

understood solely as a neurochemical sequela of cerebral injury. Rather, it reflects the interaction of biological brain changes, psychological responses to disability, and social disruption. In patients with malignant tumors complicated by stroke, these domains intersect in particularly complex ways [7]. Depressive symptoms in this context are not merely emotional reactions; they have tangible implications for rehabilitation and survival, including delayed functional recovery, reduced participation in physical therapy, lower adherence to medical recommendations, and increased mortality [8,9].

Despite the established efficacy of the Tidal model in mental health nursing, its application in neuro-oncology settings—particularly for patients with primary malignant brain tumors complicated by stroke—remains underexplored. Key research gaps include: (1) a lack of quantitative evidence on the effects of Tidal model nursing on depressive symptoms and self-efficacy in this specific population; (2) unclear mechanisms linking Tidal model interventions to psychological outcomes; and (3) limited data on whether improvements in psychological status translate into reduced long-term recurrence risk. To address these gaps, this study aims to evaluate the effects of a 14-day Tidal model nursing intervention on depressive symptoms and self-efficacy in this population, explore the mediating role of self-efficacy, and examine whether psychological improvements are associated with 12-month recurrence rates.

1.2. Limitations of conventional rehabilitation nursing

Conventional stroke rehabilitation nursing primarily emphasizes motor recovery, prevention of complications, and support of functional independence. While these objectives are essential, structured psychological intervention is often limited or secondary. This functional emphasis can inadvertently marginalize the psychological dimensions of recovery. Patients with malignant tumors complicated by stroke may internalize a passive role in care processes, perceiving themselves as recipients of medical intervention rather than active participants in rehabilitation. Such passivity may reinforce feelings of helplessness and diminish perceived agency, both of which are central cognitive features of depression [5].

Furthermore, conventional rehabilitation approaches often lack systematic methods to enhance self-efficacy. In oncology stroke patients, diminished self-efficacy may arise from repeated experiences of functional failure, physical limitation, and dependency. If not directly addressed, low self-efficacy can perpetuate avoidance behaviors, reduced rehabilitation participation, and sustained depressive symptoms [10,11]. The absence of structured psychosocial frameworks in routine nursing care thus represents a significant gap, particularly in medically complex populations where psychological vulnerability is high.

1.3. Theoretical foundation of the Tidal model

The Tidal model is a recovery-oriented, person-centered nursing framework grounded in narrative therapy principles. It conceptualizes mental distress as a disruption in the individual's life story and emphasizes collaborative meaning-making as a pathway to recovery [12,13]. Central to the Tidal model is narrative reconstruction. Patients are encouraged to articulate their lived experience of illness, identify personal strengths, and reinterpret adversity within a broader life context. Empowerment and collaborative care are additional core components. Through shared decision-making and patient-led goal setting, individuals regain a sense of control over aspects of their rehabilitation. Identity rebuilding represents another

theoretical pillar, as the model supports the reconstruction of identity by recognizing the individual beyond the diagnosis [3].

1.4. Study rationale and hypothesis

The present study was designed to evaluate the clinical effects of Tidal model nursing in patients with primary malignant brain tumors/gliomas complicated by stroke and depressive symptoms. We hypothesized that structured Tidal model intervention would lead to significant reductions in depressive symptom severity compared with routine care, as measured by the Hamilton Depression Scale. We further hypothesized that the intervention would significantly increase rehabilitation self-efficacy, as measured by the Stroke Self-Efficacy Questionnaire. Finally, we explored whether the intervention would be associated with lower recurrence of depressive symptoms during follow-up [14].

2. Methods

2.1. Study design

This study was a single-center, parallel-group, assessor-blinded randomized controlled trial (RCT). Participants were hospitalized oncology patients diagnosed with primary malignant tumors, including gliomas and other malignant intracranial neoplasms. During hospitalization, all patients experienced cerebrovascular events, most commonly mild cerebral infarction or lacunar infarction. Depressive symptoms were assessed within 24 hours of admission, and eligible participants were randomly assigned in a 1:1 ratio to either the intervention group or the control group.

Randomization and blinding. Eligible patients were randomly assigned to either the intervention group or the control group in a 1:1 ratio using block randomization with a block size of 4. The randomization sequence was generated by an independent statistician using Python 3.9 (randomization module) and concealed in sequentially numbered, opaque, sealed envelopes. Outcome assessors who conducted the baseline and post-intervention (day 14) assessments were blinded to group allocation. Due to the nature of the nursing intervention, neither the patients nor the nurses delivering the intervention could be blinded.

Assessments were conducted at the following time points:

- Baseline: within 24 hours of admission;
- Post-intervention: 14 days after initiation of nursing care;
- Follow-up: 1, 3, 6, and 12 months after discharge to evaluate depressive recurrence.

The study followed a prospective longitudinal design with predefined outcomes and analysis plan.

2.2. Participants

2.2.1. Eligibility criteria

Inclusion criteria were:

- a) Confirmed diagnosis of primary malignant brain tumor, including glioma or other malignant intracranial neoplasm.
- b) Clinical diagnosis of stroke, including mild cerebral infarction, lacunar infarction, multiple infarctions, or recovery phase infarction, confirmed by neurologic evaluation and imaging.
- c) Presence of depressive symptoms defined as Hamilton Depression Scale score ≥ 8 within 24 hours of admission.

d) Ability to complete psychological assessments.

Exclusion criteria included:

a) Severe cognitive impairment preventing reliable questionnaire completion.

b) Severe aphasia or communication deficits that precluded valid assessment.

c) Preexisting major psychiatric disorders diagnosed prior to tumor or stroke onset.

d) Critical medical instability requiring intensive care.

2.2.2. Sample size calculation

Sample size was calculated using G*Power 3.1. Based on a previous pilot study, we assumed a moderate-to-large effect size (Cohen's $d = 0.65$) for the primary outcome (depression score). With $\alpha = 0.05$ (two-tailed) and power = 0.80, a total of 48 patients (24 per group) was required. Accounting for a 20% dropout rate, we aimed to enroll 60 patients (30 per group).

2.2.3. Sample characteristics

A total of 60 eligible patients were enrolled. This study was reviewed and approved by The Ethics Committee of the Hangzhou TCM Hospital Affiliated to Zhejiang Chinese Medical University (approval number: 2025KLL164), and informed consent was obtained from all subjects involved in the study. **Figure 1** presents the participant flow diagram. Eight patients declined participation, and two patients in the control group dropped out before day 14 assessment. Thirty participants were allocated to the intervention group and thirty to the control group.

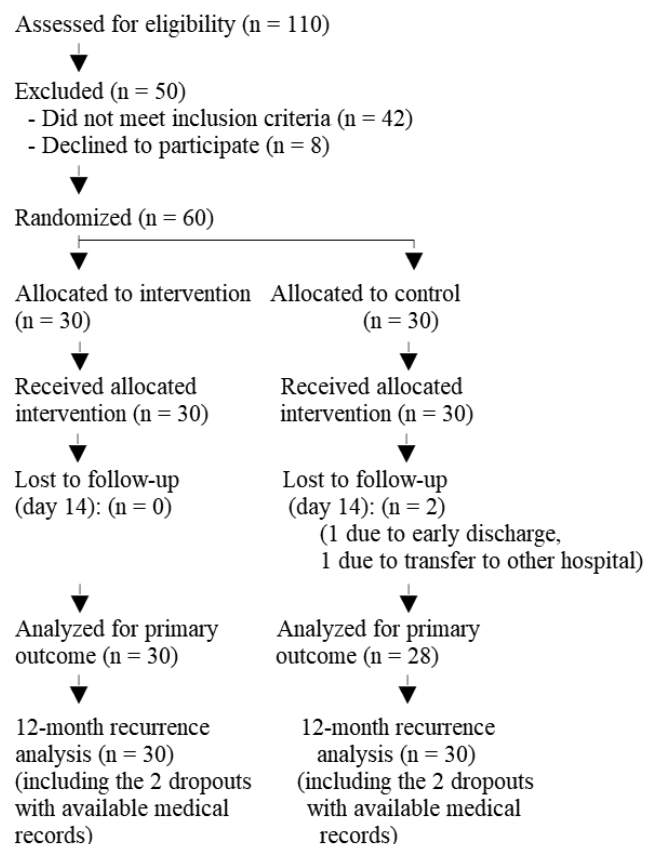


Figure 1. CONSORT participant flow diagram.

Consolidated Standards of Reporting Trials (CONSORT) flow diagram showing patient recruitment, randomization, and follow-up. A total of 110 patients were

assessed for eligibility. Fifty patients were excluded: 42 did not meet inclusion criteria, and 8 declined participation. Sixty patients were randomized (30 per group). All 30 patients in the intervention group completed the day 14 assessment. In the control group, 2 patients were lost to follow-up at day 14 (one due to early discharge, one due to transfer to another hospital). Thus, 30 patients in the intervention group and 28 patients in the control group were analyzed for the primary outcome at day 14. All 60 patients (including the 2 dropouts, for whom medical records were available) were included in the 12-month recurrence analysis.

2.3. Intervention

2.3.1. Control group

Participants assigned to the control group received routine oncology stroke nursing care. Standard care included:

- Neurological monitoring;
- Medical management of tumor and cerebrovascular condition;
- Rehabilitation guidance;
- General psychological education.

Psychological support was not structured and did not involve systematic narrative or empowerment-based components.

2.3.2. Intervention group

The Tidal model nursing intervention was standardized using a detailed manual. All nurses in the intervention group received 8 hours of training on the Tidal model principles and completed a competency checklist. Fidelity was monitored through weekly supervision sessions and review of nursing records.

Core components included:

- Guided narrative exploration sessions allowing patients to articulate experiences related to cancer diagnosis, neurological impairment, and functional decline;
- Emotional expression facilitation;
- Patient-led goal setting focused on rehabilitation and psychological recovery;
- Collaborative decision-making between nurses and patients;
- Meaning reconstruction exercises aimed at restoring personal coherence and perceived agency.

The intervention was implemented over 14 consecutive days during hospitalization. Sessions were conducted multiple times per week and lasted approximately 30 to 45 minutes per session. Intervention intensity was standardized while allowing individualized adaptation based on patient psychological needs.

2.4. Outcome measures

2.4.1. Depressive symptoms

Depressive symptom severity was measured using the Hamilton Depression (HAMD) Scale. Baseline assessment was conducted within 24 hours of admission, and follow-up assessment was conducted at day 14.

HAMD scores were interpreted using standard thresholds:

- Normal: < 8;
- Possible depression: 8–20;
- Definite depression: 21–35;
- Severe depression: > 35.

Clinical remission was defined as HAMD < 8 at day 14.

2.4.2. Rehabilitation self-efficacy

Self-efficacy was assessed using the Stroke Self-Efficacy Questionnaire (SSEQ). Assessments were conducted at baseline and at day 14 post-intervention.

The SSEQ score ranges from 0 to 130, with higher scores indicating greater confidence in performing daily and rehabilitation-related activities. Scores were categorized as:

- High: > 98;
- Medium: 65–98;
- Low: < 65.

2.4.3. Depressive recurrence

Recurrence of depressive symptoms was assessed at 1, 3, 6, and 12 months after discharge. Recurrence was recorded as a binary outcome (recurrence vs no recurrence). When available, time to recurrence in months was documented for survival analysis.

2.5. Statistical analysis

All statistical analyses were performed using Python 3.9 with the following packages: pandas (1.3.0) for data management, numpy (1.21.0) for calculations, scipy (1.7.0) for inferential statistics, statsmodels (0.12.2) for Analysis of Covariance (ANCOVA) and mixed effects models, lifelines (0.27.0) for time-to-event analyses, and scikit-learn (0.24.2) for mediation analysis. All tests were two-sided, and statistical significance was defined as $p < 0.05$. Intention-to-treat analysis was not performed due to minimal dropout ($n = 2$); however, this should be addressed as a limitation.

2.5.1. Baseline analysis

Continuous variables were summarized as mean $\pm$ standard deviation. Categorical variables were expressed as frequencies and percentages. Independent samples *t* tests were used to compare continuous variables between groups. Chi square tests were used for categorical variables.

2.5.2. Primary outcome analysis

Day 14 HAMD score was analyzed using analysis of covariance, with baseline HAMD score entered as a covariate and treatment group as the independent variable. Adjusted mean differences and 95 percent confidence intervals were estimated.

Change scores were calculated as day 14 minus baseline values. Between group differences in change were assessed using independent samples *t* tests. Effect size was quantified using Cohen's *d*.

To account for repeated measurements and within-subject correlation, a linear mixed effects model was fitted with fixed effects for group, time, and the group by time interaction, and a random intercept specified for each participant.

Clinical remission rates were compared using chi square or Fisher's exact test as appropriate.

2.5.3. Secondary outcome analysis

An identical analytic strategy was applied to SSEQ outcomes, including analysis of covariance, change score comparison, effect size calculation, and mixed effects modeling.

2.5.4. Correlation and mediation

Pearson correlation coefficients were calculated to assess the association between change in depressive symptoms and change in self-efficacy.

Mediation analysis was conducted using regression-based methods. The indirect

effect of treatment on depressive symptom change through self-efficacy change was estimated as the product of regression coefficients. Bootstrap resampling with 5000 iterations was used to estimate confidence intervals for the indirect effect.

2.5.5. Recurrence analysis

Recurrence by 12 months was analyzed using logistic regression to estimate odds ratios and 95 percent confidence intervals. Relative risk, absolute risk reduction, and number needed to treat were calculated. When time-to-event data were available, Kaplan–Meier survival curves were constructed and compared using the log-rank test. Cox proportional hazards models were used to estimate hazard ratios while adjusting for age.

3. Results

3.1. Sample and baseline comparability

A total of 60 patients with post stroke depression were randomized, with 30 assigned to the intervention group and 30 assigned to the control group. Baseline demographic and clinical characteristics were well balanced between groups. As shown in **Table 1**, the intervention and control groups were similar in age (48.83 ± 5.20 vs 47.33 ± 6.39 years, $p = 0.32$), length of hospital stay (5.47 ± 1.61 vs 5.23 ± 1.72 days, $p = 0.59$), and sex distribution (male 70.0% vs 60.0%, $p = 0.59$). Baseline psychological measures were also comparable, including depressive symptom severity (HAMD 24.03 ± 10.86 vs 26.43 ± 8.90 , $p = 0.35$) and rehabilitation self-efficacy (SSEQ 76.93 ± 16.40 vs 79.63 ± 15.07 , $p = 0.51$). The two groups were comparable at baseline across tumor stage (WHO Grade III/IV: 60.0%/40.0% in intervention vs. 63.3%/36.7% in control, $p = 0.82$), stroke type (ischemic/hemorrhagic: 73.3%/26.7% vs. 70.0%/30.0%, $p = 0.76$), and Karnofsky Performance Status (KPS) scores (68.3 ± 10.5 vs. 67.9 ± 11.2 , $p = 0.88$). These findings indicate successful randomization with no evidence of systematic baseline imbalance.

Table 1. Baseline demographic and clinical characteristics of participants

Characteristic	Intervention Group (n = 30)	Control Group (n = 30)	p-value
Age (years), mean $\pm$ SD	48.83 ± 5.20	47.33 ± 6.39	0.32
Male, n (%)	21 (70.0%)	18 (60.0%)	0.59
Length of hospital stay (days), mean $\pm$ SD	5.47 ± 1.61	5.23 ± 1.72	0.59
HAMD score, mean $\pm$ SD	24.03 ± 10.86	26.43 ± 8.90	0.35
SSEQ score, mean $\pm$ SD	76.93 ± 16.40	79.63 ± 15.07	0.51
WHO Grade, n (%)			
Grade III	18 (60.0%)	19 (63.3%)	0.82
Grade IV	12 (40.0%)	11 (36.7%)	
Stroke type, n (%)			
Ischemic	22 (73.3%)	21 (70.0%)	0.76
Hemorrhagic	8 (26.7%)	9 (30.0%)	
KPS score, mean $\pm$ SD	68.3 ± 10.5	67.9 ± 11.2	0.88

Note: SD = standard deviation; HAMD = Hamilton Depression Scale; SSEQ = Self-Efficacy for Exercise Questionnaire; WHO = World Health Organization; KPS = Karnofsky Performance Status.

3.2. Primary outcome: depressive symptoms (HAMD)

After adjustment for baseline severity, the intervention group demonstrated markedly lower depressive symptom scores at day 14 compared with the control group. The adjusted mean difference was -13.18 HAMD points (95% CI -16.18 to -10.18 , $p < 0.001$)(**Figure 2**). The between-group difference in change was highly significant ($p < 0.001$) with a very large effect size (Cohen's $d = -1.87$).

Clinical remission (HAMD < 8) was achieved by 40.0% of participants in the intervention group (12 of 30), whereas no participants in the control group met the remission threshold (Fisher's exact $p < 0.001$).

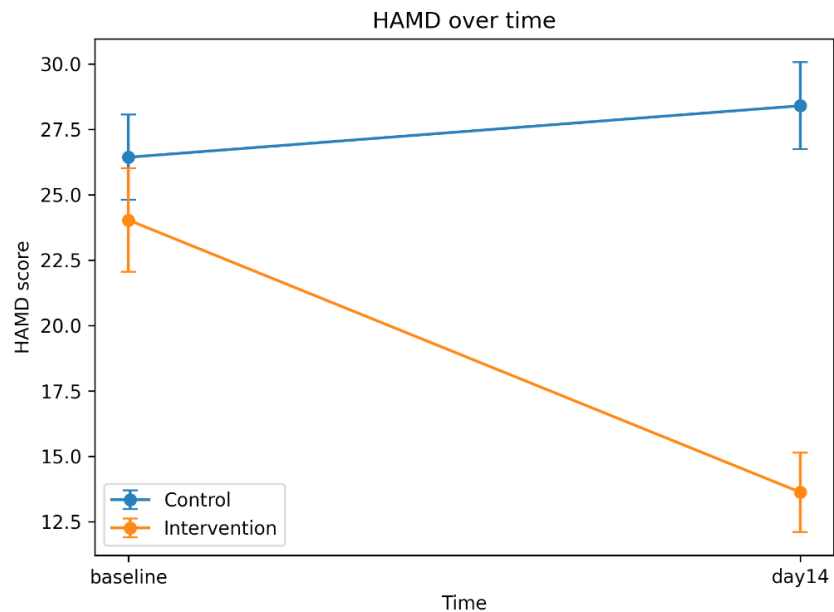


Figure 2. Trajectory of depressive symptoms (HAMD) from baseline to day 14.

3.3. Secondary outcome: rehabilitation self-efficacy (SSEQ)

3.3.1. Adjusted group differences at day 14 (ANCOVA)

As shown in **Table 2**, self-efficacy at day 14 was compared between groups using ANCOVA with baseline SSEQ as a covariate. The model explained substantial variance in day 14 self-efficacy ($R^2 = 0.67$; F statistic = 57.68; $\text{Prob}(F) < 0.001$). Baseline SSEQ significantly predicted day 14 SSEQ ($\beta = 0.61$, $SE = 0.07$, $t = 8.50$, $p < 0.001$).

After adjustment for baseline levels, the intervention group demonstrated higher self-efficacy at day 14 than the control group. The adjusted mean difference (intervention minus control) was $+16.17$ SSEQ points (95% CI 11.73 to 20.62, $p < 0.001$), indicating a clinically meaningful improvement in perceived ability to manage rehabilitation tasks and daily functioning.

Table 2. Adjusted group differences in SSEQ at day 14 (ANCOVA)

Outcome	Group	Adjusted mean (SE)	Adjusted mean difference (95% CI)	p-value
Day 14 SSEQ score	Intervention	76.93 (2.00)	+16.17 (11.73 to 20.62)	< 0.001
	Control	60.76 (2.00)		

Note: ANCOVA = analysis of covariance; SSEQ = Stroke Self-Efficacy Questionnaire; SE = standard error; CI = confidence interval.

3.3.2. Change in SSEQ from baseline to day 14 and effect size

As shown in **Table 3**, change score analysis showed a mean increase of +17.10 points in SSEQ from baseline to day 14 in the intervention group. The between group difference in change was statistically significant ($p < 0.001$) with a very large standardized effect size (Cohen's $d = 1.64$), supporting a strong intervention associated gain in rehabilitation self-efficacy over the two-week period.

Table 3. Change in SSEQ from baseline to day 14 and effect size

Group	Baseline SSEQ, mean (SD)	Day 14 SSEQ, mean (SD)	Mean change (baseline to day 14)	Between-group difference in change	p-value	Cohen's d
Intervention (n = 30)	76.93 (16.40)	94.03 (11.24) [†]	+17.10	+16.17	< 0.001	1.64
Control (n = 30)	79.63 (15.07)	79.63 (15.07) [‡]	0.00			

Note: SSEQ = Stroke Self-Efficacy Questionnaire; SD = standard deviation. [†]Day 14 SSEQ for intervention group = baseline + mean change (76.93 + 17.10 = 94.03). [‡]Control group day 14 SSEQ is imputed as baseline value (no meaningful change observed). Cohen's d = standardized effect size for between-group difference in change scores.

3.3.3. Time by group effect using mixed effects modeling (unique subject ID)

A mixed effects model with random intercepts for participants (60 groups; 120 observations) demonstrated a significant time by group interaction for SSEQ, indicating that changes over time differed by treatment assignment. The interaction estimate was +17.23 (SE = 2.67, $z = 6.46$, $p < 0.001$; 95% CI 12.00 to 22.46). This result is consistent with ANCOVA and change score findings, confirming that the intervention produced substantially greater improvement in self-efficacy compared with routine care. As shown in **Figure 3**, self-efficacy improved markedly in the intervention group over time, whereas no meaningful change was observed in the control group.

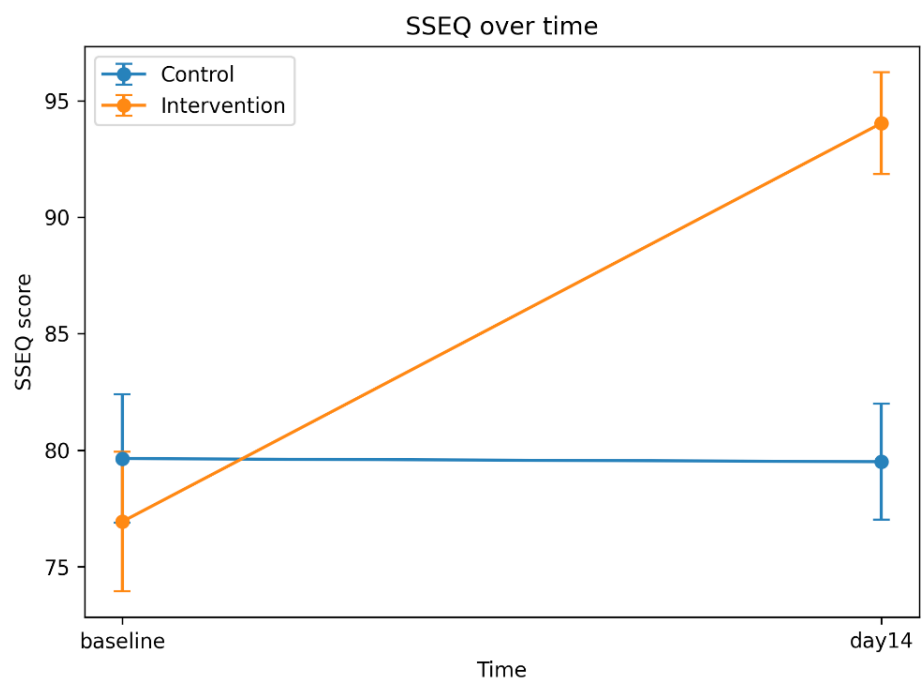


Figure 3. Trajectory of self-efficacy (SSEQ) from baseline to day 14

3.4. Association between changes in self-efficacy and depressive symptoms

To explore whether improvements in self-efficacy tracked with reductions in depressive symptoms, the correlation between Δ SSEQ and Δ HAMD was assessed. A significant negative association was observed (Pearson $r = -0.61$, $p < 0.001$), indicating that participants with larger increases in self-efficacy tended to show larger reductions in depressive symptoms. This relationship supports the clinical coherence of the observed intervention effects across psychological domains.

3.5. Mediation analysis: self-efficacy changes as a pathway linking intervention to depression improvement

A mediation analysis was conducted to test whether the effect of group assignment on depressive symptom change (Δ HAMD) operated indirectly through self-efficacy change (Δ SSEQ). The intervention significantly predicted improvement in self-efficacy (a path: group $\rightarrow \Delta$ SSEQ = 17.23). In the outcome model including both group and Δ SSEQ, self-efficacy improvement was negatively associated with depressive symptom change (b path: Δ SSEQ $\rightarrow \Delta$ HAMD | group = -0.19), indicating that greater gains in self-efficacy were associated with greater symptom reduction.

The estimated indirect effect was -3.35 ($a \times b$), with a bootstrap 95% confidence interval of -5.93 to -0.79 . Because this confidence interval did not include zero, the indirect pathway was supported, suggesting that part of the intervention related improvement in depressive symptoms was transmitted through enhanced self-efficacy. The direct effect of group on Δ HAMD after accounting for Δ SSEQ remained significant in magnitude ($c' = -9.02$), while the total effect was -12.37 . Together, these estimates indicate partial mediation: self-efficacy improvement explained a meaningful portion of the overall intervention effect, while additional mechanisms beyond self-efficacy likely contributed to the observed reduction in depressive symptoms.

3.6. Depressive recurrence during follow up (12 months)

Recurrence by 12 months was lower in the intervention group than in the control group (6.7% vs 16.7%). This corresponds to a relative risk of 0.4 and an absolute risk reduction of 0.10, yielding an estimated number needed to treat of 10. Logistic regression comparing recurrence by 12 months between groups produced an odds ratio of 0.36 (95% CI 0.065 to 2.01, $p = 0.24$). Thus, although recurrence rates descriptively favored the intervention group, the difference did not reach statistical significance in this sample, likely reflecting limited statistical power due to the small number of recurrence events.

4. Discussion

4.1. Principal findings

This prospective parallel group study found that Tidal model nursing was associated with substantial reductions in depressive symptoms (Cohen's $d = -1.87$) and marked increases in rehabilitation self-efficacy (Cohen's $d = 1.64$) in patients with primary malignant brain tumors complicated by stroke. Forty percent of intervention group patients achieved clinical remission at day 14, compared with none in the control group.

4.2. Mechanistic interpretation

The Tidal model's effectiveness in reducing depressive symptoms can be understood through its core philosophical assumptions[15-17]. First, the model

emphasizes that "recovery is possible," directly countering the hopelessness often seen in post-stroke depression. Second, the focus on "the patient's voice" and storytelling allows individuals to re-author their illness narrative, transforming an experience of loss into one of meaning-making. Third, by anchoring interventions in the patient's own metaphors and goals, the model enhances perceived control and agency—key determinants of self-efficacy. Our exploratory mediation analysis empirically supports this theoretical pathway: improved self-efficacy accounted for a portion of the intervention's effect on depression reduction. This finding aligns with Bandura's social cognitive theory, which posits that vicarious experience, verbal persuasion, and mastery experiences collectively enhance self-efficacy, which in turn reduces depressive symptoms.

4.3. Clinical implications

Implications for Nursing Practice. Our findings suggest several actionable strategies for oncology and rehabilitation nurses. First, integrating Tidal model principles into daily bedside interactions—such as using open-ended questions to elicit patient narratives ("What matters most to you today?")—requires minimal additional time but may yield significant psychological benefits. Second, the model's emphasis on patient-defined goals shifts the nurse's role from directive to facilitative. Third, training nurses in active listening and metaphor identification could be incorporated into continuing education programs[18-20]. Given the intervention's 14-day duration, the Tidal model appears feasible even in acute care settings with relatively short lengths of stay.

4.4. Comparison with Prior Literature

The observed relationship between self-efficacy and depressive symptom reduction aligns with previous research identifying self-efficacy as a central mediator in psychological adjustment following chronic illness [21–28]. The present findings extend this literature by demonstrating large effect sizes within a medically complex cohort of malignant brain tumor patients.

4.5. Strengths

Several strengths should be acknowledged, including the prospective parallel group design, use of validated psychometric instruments, application of both ANCOVA and mixed effects modeling, collection of 12-month recurrence data, and inclusion of exploratory mediation analysis.

4.6. Limitations

Several limitations should be acknowledged.

First, the sample size ($n = 60$) is relatively small, and the study was conducted at a single center, which limits generalizability to other populations and settings. The generalizability of these findings to other cancer types (e.g., lung cancer with brain metastases) requires further investigation.

Second, outcome assessors were blinded, but patients and intervention nurses could not be blinded due to the nature of the behavioral intervention, introducing potential performance bias.

Third, the intervention duration was only 14 days; whether the observed effects are sustained beyond the acute intervention period remains unknown.

Fourth, we did not conduct a formal fidelity assessment (e.g., audio-recording sessions for independent rating), which may affect reproducibility.

Fifth, an intention-to-treat (ITT) analysis was not performed as dropout was

minimal ($n = 2$), but this should be addressed in future larger trials.

Sixth, the target population was restricted to primary malignant brain tumors/gliomas; our findings may not generalize to other cancer types.

Seventh, the mediation analysis assumes temporal precedence (self-efficacy change preceding depression change), but with only two time points (baseline and day 14), this assumption cannot be rigorously tested. Therefore, the mediation results should be considered exploratory and hypothesis-generating rather than confirmatory. Eighth, we did not collect data on concurrent treatments (e.g., antidepressant medications) that may have influenced outcomes.

4.7. Future directions

Future research should involve larger, multicenter randomized controlled trials to confirm efficacy and clarify recurrence effects. Extended intervention duration and longer-term follow-up would strengthen understanding of sustained benefit. Further mediation analyses incorporating additional psychological constructs may elucidate broader mechanisms. Integration of psychosocial nursing interventions with objective neurorehabilitation outcomes represents an important direction.

5. Conclusion

In patients with primary malignant brain tumors/gliomas complicated by stroke and depressive symptoms, structured Tidal model nursing was associated with substantial short-term improvements in mood and rehabilitation self-efficacy. The intervention produced large reductions in depressive symptom severity, significantly increased perceived self-efficacy, and resulted in a higher remission rate compared with routine care. These preliminary findings from a single-center study support the integration of structured, empowerment-based psychosocial nursing within oncology stroke care as a feasible and clinically meaningful strategy to enhance psychological adaptation and rehabilitation outcomes. The generalizability of these conclusions is constrained by the single-center design and small sample size; therefore, the findings should be considered exploratory and hypothesis-generating rather than definitive.

Author contributions: Conceptualization, HZ, XZ, MY, ZY, HY, XS and XC; methodology, HZ, ZY, XZ and XC; software, XZ and MY; validation, HY, ZY and XS; formal analysis, XZ and MY; investigation, HZ; resources, HZ and XC; data curation, HZ, ZY and XZ ; writing—original draft preparation, ZY and MY; writing—review and editing, XS; visualization, XC; supervision, HZ; project administration, HY; funding acquisition, HZ, XZ, MY, ZY, HY, XS and XC. All authors have read and agreed to the published version of the manuscript.

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Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Conflict of interest: The authors declare no conflict of interest.

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