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Effect of Early Rehabilitation Program on Attention and Balance for Patients following Craniotomy

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Abstract
Background: Attention and balance impairments are common disorders following craniotomy. **Aim:** Evaluate the effect of early rehabilitation program on attention and balance for patients following craniotomy. **Patients and Methods:** A randomized controlled trial design was used for a sample of 62 oriented patients following craniotomy for removal of brain tumor with mild impaired attention and balance. Patients were attended to neurosurgery department at Neurological, Psychiatric and Neurosurgery Assiut University Hospital and outpatients clinic. Patients assigned randomly into rehabilitation group (odd number) and control group (double number). An early rehabilitation program was applied to the rehabilitation group (teaching booklet). Patients were followed up for 3 months in neurosurgery department and outpatients clinic. Tools: Patients assessment sheet following craniotomy, mini–mental state examination, Berg balance scale and survey about patients satisfaction. **Results:** Statistical significant improvements were found among patients in rehabilitation group regarding their attention and balance mean scores than patients in control group (p. value < 0.01). Moreover, patients in rehabilitation group were satisfied with program outcomes. **Conclusion:** Implementation of early rehabilitation program showed highly statistical significant improvements in attention and balance mean scores among patients of rehabilitation group than control group. **Recommendation:** Early rehabilitation program should be implemented for all patients following craniotomy after individualized comprehensive evaluation at different hospitals.

Keywords: Attention, Balance, Craniotomy & Early rehabilitation program

Introduction
Despite improvements in the management of primary brain tumors, it continues to result in significant morbidity and mortality. Currently, the standard of care for newly diagnosed patients with primary brain tumors is maximal resection of the tumor, followed by adjuvant chemotherapy or radiation **(Tan et al., 2020)**.

Craniotomy is the most common surgical procedure used to remove brain tumors. It is a surgical operation in which a bone flap is removed from the skull to access the brain. Nursing assessment of patients after craniotomy should be frequent and thorough focusing on the potential to develop neurological deterioration from continued increased intracranial pressure, seizure, hydrocephalus, effusion or hematoma **(Xu et al., 2014)**.

Balancing between the maximal resection of the brain tumors and the preservation of the neurological function can be challenging due to infiltrative nature of the brain tumors and the short-term postoperative course which is frequently complicated by major adverse events, often resulting in extended length of hospital stay, reoperation and readmission **(Krivosheya et al., 2016)**.

The reason for postoperative neurological deficit is not always clear and often is difficult to predict the course of deteriorated function. Preoperative assessment can give more precise information regarding postoperative outcomes **(Zetterling et al., 2020)**.

Many patients recovering from craniotomy experience some degree of physical and/or cognitive changes. Patients' abilities to take information slowed and vulnerability to distractions increased. Fatigue, cognitive functions as attention, concentration and memory can be affected to a varying degree. Many patients experience dizziness and impaired balance at some point in their recovery. Balance impairment can restrict the patients` activities of daily living and their participation in social life. It is necessary to determine the severity of physical and cognitive impairments and accordingly develop the rehabilitation plan **(Abu-Hegazy, El-Hadaad, 2016 & Alashram et al., 2020)**.

Those symptoms can be addressed through physical and cognitive rehabilitation. Neurosurgery nurses have active and effective role in rehabilitation of patients following craniotomy. Rehabilitation and nursing management are important means for caring of patients following craniotomy.

It can reduce the disability rate and improve quality of life and mental state for patients **(Li et al., 2016)**.
The purpose of rehabilitation following intracranial surgery for removal of brain tumor is to restore independence with emphasis on daily living activities, movement, cognition and communication. The rehabilitation goals always adjust according to patients problems. The rehabilitation need to be starting early enough to reach the established goals, prevent complications and achieve better outcomes **(Yu et al., 2019)**.

Significance of the study
According to the literature, balance and attention deficits are common impairments in patients managed by craniotomy for removal of brain tumor. Balance and attention deficits can restrict the patients` activities of daily living and their participation in social life. To date, few studies have examined the effect of early rehabilitation on balance and attention following craniotomy for removal of brain tumor. So, we conducted this study to improve attention and balance for patients following craniotomy.
According to hospital records at Neurological, Psychiatric and Neurosurgery Assiut University Hospital during the period of one year (2020), it has been found that 210 patients admitted to the Neurosurgery Department and managed by craniotomy **(Assiut University Hospital Record, 2020)**.

Aims of the study
General objective
Evaluate the effect of early rehabilitation program on attention and balance for patients following craniotomy.
Specific objectives
1. Improve attention and balance for patients following craniotomy.
2. Investigate satisfaction of patients in rehabilitation group with the rehabilitation program outcomes.

Research Hypothesis
1. Rehabilitation group will show significant improvements in attention and balance than control group.
2. Rehabilitation group will be satisfied with the rehabilitation program outcomes.

Patients and Methods
Research design
A randomized controlled trial design was used to conduct the study.
Study variables
The independent variable was the early rehabilitation program, while the dependent variables were the attention and balance of patients following craniotomy.

Sample and setting
A random sample of 62 adult male and female patients was recruited to the study through a period of 6 months; two groups of patients were assigned randomly [odd number = rehabilitation group (31 patients) and double number = control group (31 patients)].
Inclusion criteria: Fully conscious; Glasgow coma scale (GCS) score of 14 or 15, age ranged from 18 to 65 years old, patients newly diagnosed with brain tumor and planned for treatment with craniotomy in neurosurgery department at Neurological, Psychiatric and Neurosurgery Assiut University Hospital. Postoperative inclusion criteria included patients with mild impaired attention; difficult focusing and being easily distracted [mini–mental state examination (MMSE) score 19-23], and mild impaired balance [Berg balance scale (BBS) score less than 20] following craniotomy with GCS score of 14 or 15.
Exclusion criteria: Unconscious patients, substance abuse, memory disorders, history of dementia, patients who cognitively unable to follow directions, epilepsy, intracranial infection, aphasia, and patients with previous history of brain surgery.
Control group received the routine neurosurgery hospital care while rehabilitation group received the neurosurgery hospital care in addition to the early rehabilitation program developed by the researchers. Attention and balance were assessed before craniotomy, immediate postoperative following craniotomy, before discharge, at 1 month and 3 months of follow up.
Tools:
Tool I: Patients assessment sheet following craniotomy:
It was used to assess patients` demographic data, co-morbidities, type of brain tumor, diagnostic studies, length of hospitalization, and level of consciousness using GCS developed by **Teasdale & Jennette (1974)** to assess level of consciousness.
Tool II: Mini–mental state examination (**MMSE**)**:**
It was developed originally by **Folstein et al. (1975)**. It was 30-point questionnaire used to assess cognitive function; registration [repeating named prompts], attention, calculation, recall, language, patients ability to follow simple commands and orientation.
Total score = 30. A score of 24-30 = no cognitive impairment, 19-23 = mild cognitive impairment, 10-18 = moderate cognitive impairment and 0-17 = severe cognitive impairment.
Tool III: Berg balance scale (BBS):
It was developed by **Berg et al. (1989)** to measure balance ability; static and dynamic among adults. It measured balance ability through performing functional activities. It was 14-items, divided into 3 categories of functional activities [sitting balance (1

item), standing balance (8-items) and dynamic balance (5-items)]. Each item is rated on five-point scale ranging from (0 to 4), 0 indicating lowest level of function and 4 highest level of function. A sum determined for each score (possible scores from 0 to 56). Higher score = lower fall risk. A score of 0-20 = balance impairment, 21-40 = acceptable balance, 41-56 = good balance.

Tool IV: Survey about patients satisfaction in patients with brain tumor:

This survey contains 6-items evaluated the opinion of patients/caregivers regarding efficacy of rehabilitation program on improvements in: motor function, cognition, daily living activities, intensity of rehabilitation therapy was adequate, overall satisfaction with rehabilitation and recommend rehabilitation to other patients with the same conditions. The response to the survey included the following: completely satisfied, satisfied, neutral, dissatisfied, or completely dissatisfied **(Yu et al., 2019)**.

Tool V: Patient training schedule:

It was developed by the researchers to ensure patients` commitment to the early rehabilitation program. It included two schedules; schedule for attention and concentration exercises and schedule for core and balance exercises for brain rehabilitation.

Ethical considerations

Before conducting the research, ethical approval from the scientific research ethical committee at faculty of nursing was obtained and also from the hospital authorities of neurosurgery department at neurological, psychiatric and neurosurgery Assiut University Hospital. Oral consent was obtained to participate in this study after explaining the aim of this study to the patients. The researchers informed the patients that this study was voluntary; they had the right to withdraw from this study at any time without giving any explanation. Also, they assured that their data would be confidential.

Procedure

Validity of the used tools

The tools content validity was tested for appropriateness, clarity, comprehensiveness and relevance and reviewed by seven experts in the medical-surgical nursing field and neurosurgery field (3 assistant professors of medical-surgical nursing staff and 2 professors and 2 assistant professors of neurosurgery staff in Assiut University). Modifications for the study content were done to ensure visibility of sentences and suitability of the study content.

Reliability of the used tools

The reliability for GCS used in tool I was assessed by the standard criterion of a kappa statistic (k) above 0.6. Tool II by correlation coefficient (0.95). Tool III by Cronbach's alpha test (0.98) and tool IV by correlation coefficient (0.78).

A pilot study:

It was conducted on 10% (3 patients from each group) to ensure the visibility and applicability of the study tools and time required to be completed. According to the results of the pilot study, the necessary modifications were performed. Patients involved in the pilot study did not included in the present study sample.

Fieldwork

The researchers met the selected patients and baseline data were collected using study tools I, II, and III. They were randomly assigned to [odd number = rehabilitation group (31 patients) and double number = control group (31 patients)]. After the presence of mild attention deficit and impaired balance in the patients before and following craniotomy which was confirmed by the diagnosis of neurosurgeons and by tool II (MMSE scale) and tool III (BBS). Each tool was taken from 10-20 minutes to fill out by the researchers.

Postoperatively, the patients in control group received the routine hospital care (neurological examination, instructed family members to talk to patients and orient them frequently to the surroundings to attract their attention), while the patients in rehabilitation group received additionally an early rehabilitation program and a teaching booklet was given to them. Patients were followed up for 3 months postoperatively.

The goal of early postoperative rehabilitation was to improve attention and balance for patients with brain tumor and treated by craniotomy. The rehabilitation following craniotomy started immediately during postoperative period. The early rehabilitation program content, intensity and frequency tailored to the patient's clinical needs.

The rehabilitation group received 2 × 1hour sessions daily through the hospitalization period; in the morning and afternoon shifts. The first session for attention and concentration exercises and the second session for core and balance exercises for brain rehabilitation. Patients educated and trained to do the exercises and performed those exercises under the researchers' supervision and assistance during hospitalization. Caregiver/family member was attended the sessions and educated about the early rehabilitation program to assist patients to complete their rehabilitation program in correct and successful manner and maintain faster recovery. Patients were instructed to perform the two types of exercises 1 time/day at home under family supervision to complete the rehabilitation period (3 months).

Early rehabilitation program (teaching booklet):

It was developed by the researchers guided by **[Freire et al. (2011); Trivedi et al. (2014); Church, (2020); Maher, (2020)].** It was developed in Arabic to meet the needs of patients following craniotomy to improve their attention and balance. It included the following:

- Strategies for maintain orientation, attention and concentration.
- Strategies for maintain early mobilization and socialization.
- Attention and concentration exercises:
  These exercises helped to improve patients' abilities to pay attention and focus to more than one thing at the same time. It was performed once daily for 3 months. It included: repeat numbers and letters, rhythm matching, add 3 / subtract 7, practice fine motor exercises, use non-dominant hand and sit outside and journal.
- Core and balance exercises for brain rehabilitation:
  It helped to improve coordination and gait. It was performed once daily for 3 months. It included: lateral trunk flexion (Oblique crunches), weight shifts, seated trunk extension, Romberg stance, calf raises, forward punches, staggered stance and core toe taps.

Patients` commitment to the early rehabilitation program was followed up through patient training schedule (tool V). Each exercise was recorded by the patients/family member, making it possible to confirm their implementation status to the early rehabilitation program.

The MMSE and BBS were evaluated before discharge, 1 month, and 3 months for the rehabilitation and the control groups using tool II and III. Follow up was done in neurosurgery outpatients clinic.

At the end of follow up (3 months postoperatively) satisfaction of the rehabilitation group with the effect of the early rehabilitation program was evaluated using tool IV in neurosurgery outpatients clinic.

Statistical analysis:

The statistical package for social sciences version 21.0 was used for data analyses. Independent t-test and chi-square test were used to compare the patients of both groups in terms of demographic characteristics and medical data. The significance of the comparison between rehabilitation and control groups in balance and attention improvements was confirmed by independent sample t-test. Chi-square test was used to detect overall satisfaction with efficacy of program on improvements in motor and cognitive functions, activities of daily living, intensity of rehabilitation and recommend early rehabilitation program to other patients. Statistical significance was set ($p<0.05$).

Results

Table (1): Frequency and percentage distribution of demographic characteristics and medical data of the studied patients in both groups

Variables	Rehabilitation Group (n=31)		Control Group (n=31)		P- value
	No.	%	No.	%	
Age (years) Mean ± SD	55.3±9.92		53.8±10.74		0.072
Sex					
Male	19	61.29	20	64.51	0.238
Female	12	38.70	11	35.48	
Marital status					
Married	26	83.87	29	93.54	0.865
Single	4	12.90	2	6.45	
Level of education					
University	5	16.12	9	29.03	0.624
Secondary	18	58.06	13	41.93	
Primary	2	6.45	4	12.90	
Read and write	4	12.90	2	6.45	
Illiterate	2	6.45	3	9.67	
Occupation					
Manual work	6	19.35	3	9.67	0.251
Machinery work	4	12.90	6	19.35	
Office work	21	67.74	22	70.96	
Co-morbidities					
Diabetes mellitus	3	9.67	5	16.12	0.076
Hypertension	5	16.12	2	6.45	
Diagnostic studies					
Computed tomography scan	31	100	31	100	0.063
Magnetic resonance imaging	6		4	12.90	
Type of brain tumor					
Benign	28	90.32	30	96.77	0.149
Malignant	3	9.67	1	3.22	
Length of hospitalization (days) (Mean ± SD)	9.34±6.82		13.80±7.54		0.04*
Level of consciousness (Mean ± SD)					
Preoperative GCS	13.0±2.0		13.0±2.0		0.062
Postoperative GCS	14.0±1.0		14.0±1.0		

Significant p<0.05 *Non significant p>0.05*

Table (2): Distribution of the patients cognitive function mean scores in both groups (preoperative and immediate postoperative), before discharge, 1 month and 3 months at follow up

Cognitive function			
Time of Evaluation	**Rehabilitation group (n=31)**	**Control group (n=31)**	**P- value**
	Mean ± SD	**Mean ± SD**	
Preoperative	19.3±1.9	19.2±1.4	0.238
Immediate postoperative	19.5±2.7	19.7±2.3	0.246
Before discharge	23.1±4.7	20.5±2.8	0.001**
1 month postoperatively	24.6±6.4	21.7±2.4	0.001**
3 months postoperatively	25.0±5.0	22.8±3.6	0.001**

Significant p<0.01 *Non significant p>0.05*

Table (3): Frequency and distribution of the patients balance mean scores in both groups (preoperative and immediate postoperative), before discharge, 1 month and 3 months at follow up

Balance					
Time of Evaluation	**Rehabilitation group (n=31)**		**Control group (n=31)**		**P- value**
	No.	**%**	**No.**	**%**	
Preoperative Balance impairment (0-20)	31	100	31	100	0.941
Mean ± SD	17.0±2.4		17.2±2.8		
Immediate postoperative Balance impairment (0-20)	31	100	31	100	0.923
Mean ± SD	17.1±2.5		17.4±2.9		
Before discharge					0.001**
Balance impairment (0-20)	-	-	2	6.45	
Acceptable balance (21-40)	31	100	29	93.54	
Good balance (41-56)	-	-	-	-	
Mean ± SD	32.4±3.5		27.6±6.4		
1 month postoperatively					0.001**
Balance impairment (0-20)	-	-	-	-	
Acceptable balance (21-40)	24	77.41	29	93.54	
Good balance (41-56)	7	22.58	2	6.45	
Mean ± SD	44.4±10.5		39.4±12.2		
3 months postoperatively					0.001**
Balance impairment (0-20)	-	-	-	-	
Acceptable balance (21-40)	4	12.90	21	67.74	
Good balance (41-56)	27	87.09	10	32.25	
Mean ± SD	46.4±9.8		42.1±10.8		

Significant p<0.01 *Non significant p>0.05*

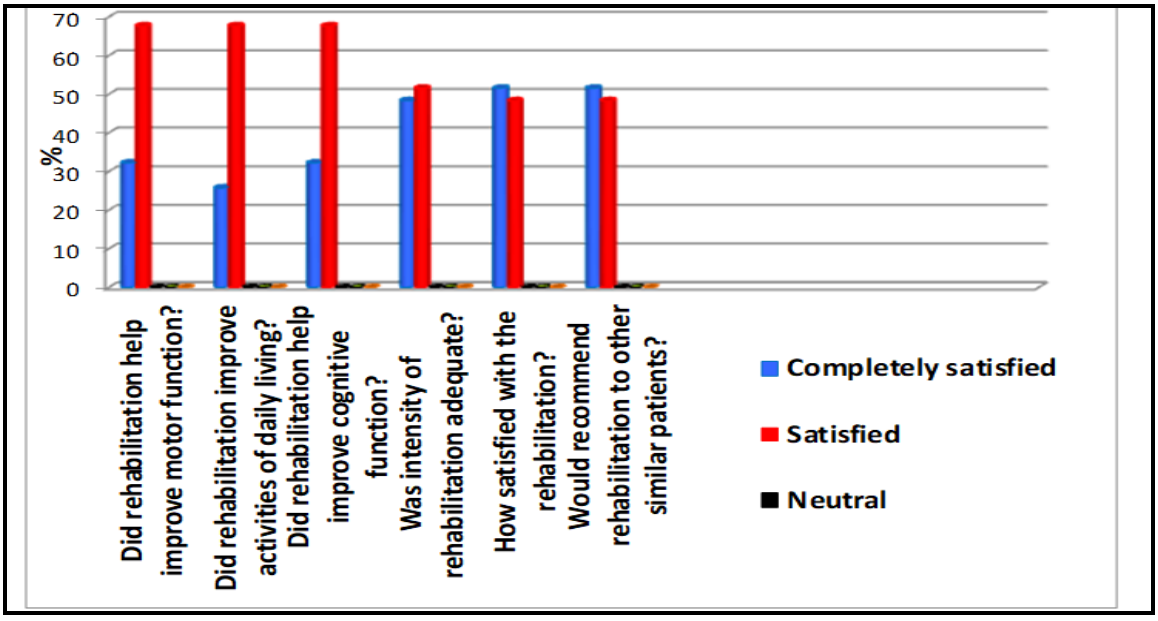

Figure (1): Patients satisfaction level in rehabilitation group at the end of follow up period (3 months) postoperatively (n = 31)

Table (1): Revealed that no significant statistical differences were found between patients in both the rehabilitation and control groups regarding the demographic characteristics and medical data (p. value > 0.05) except length of hospital stay (p. value < 0.05). The mean ages of them were 55.3±9.92 and 53.8±10.74 years respectively. More than half of them were males 19 (61.29%) and 20 (64.51%) respectively and the majority were married 26 (83.87%) and 29 (93.54%) respectively and diagnosed with benign brain tumor 28 (90.32%) and 30 (96.77%) respectively. The mean length of hospitalization for patients in rehabilitation group was fewer than the control group [9.34±6.82 and 12.80±7.54 days respectively]. Both groups were having the same mean scores regarding level of consciousness using GCS 13.0±2.0 preoperative and 14.0±1.0 postoperative.

Table (2): Showed that no significant statistical difference was found between patients in both groups (rehabilitation and control) preoperative and immediate postoperative regarding their cognitive function mean score (p. value > 0.05). Although marked improvement in mean score was found in both groups before discharge, 1 month and 3 months postoperatively. However, the improvement was highly significant in the rehabilitation group compared to the control group (p. value < 0.01).

Table (3): Displayed that no significant statistical difference was found between patients in both groups (rehabilitation and control) regarding their balance ability mean score (p. value > 0.05). Although, there an obvious improvement in mean score before discharge, 1 month and 3 months postoperatively among both groups. However, the improvement was highly in the rehabilitation group than in the control group (p. value < 0.01).

Figure (1): Illustrated that the early rehabilitation program resulted in improvements in every outcome measures of the satisfaction survey. About 32.25% of rehabilitation group was completely satisfied and 67.74% satisfied with rehabilitation; it was effective in improving motor (balance), activities of daily living, and cognition (attention and concentration). More than 90% answered positively about how satisfied with rehabilitation (51.61% completely satisfied and 48.38% satisfied), adequate intensity of the early rehabilitation program (48.38% completely satisfied and 51.61% satisfied), and recommend early rehabilitation program to other patients (51.61% completely satisfied and 48.38% satisfied).

Discussion

Many patients following intracranial surgery are needed early rehabilitation, initial or subsequent to the appearance of motor and/or cognitive impairments. Though still controversial, early rehabilitation has been shown to be useful in improving motor and/or cognitive functions in brain tumor patients, although the majority in observational studies rather than randomized controlled trials studies **(Zucchella et al., 2013)**. So, this study conducted using randomized controlled trial research design in an attempt to evaluate the effect of early rehabilitation program using teaching booklet for patients whom candidate for craniotomy for removal of brain tumor and to compare with patients whom had no early rehabilitation program (teaching booklet).

This study showed that the mean age was 55.3±9.92 years for rehabilitation group and was 53.8±10.74 years for control group and more than half of both groups were males and the majority were married. The baseline preoperative mean GSC was 13.0±2.0 for rehabilitation and control groups. The baseline postoperative mean GSC was 14.0±1.0 for rehabilitation and control groups.

These study results support those of **Abdelmowla et al. (2017)** who conducted a study on 124 patients after craniotomy with mean age was 37.5± 18.6 years for study group and 39.2± 16.5 years for control group. More than half of both groups were males with baseline GSC 14.36±1.21 for study group and 13.57±2.53 for control group.

Statistical significant difference was found regarding length of hospitalization between rehabilitation and control groups. Control group had more length of hospitalization stay than rehabilitation group. From the researchers opinions this could be due to the effect of the early rehabilitation program for the rehabilitation group patients. The rehabilitation group showed rapid improvement in attention and balance during hospitalization and before discharge as a result of implementing the strategies for maintain orientation, attention and concentration and the strategies for maintain early mobilization and socialization. Also, as a result of the daily exercises practice during hospitalization (attention and concentration exercises and core and balance exercises) under supervision of the researchers and patients` families. Finally, rapid improvements resulting in shorter hospitalization stay.

Study results of **Guerra et al. (2015)** supported the present study result which showed that early postoperative rehabilitation led to reduced incidence and duration of delirium, less hospitalization days, and a more likely return to independent functional status at discharge.

Based on inclusion criteria, this current study result found that no statistical significant difference was found between rehabilitation and control groups as regard impairment in cognitive function (attention

deficit) at assessment baseline; preoperative and immediate postoperative after craniotomy. Study results of **Singh et al. (2021)** reported that cognitive impairment detected by MMSE was observed in patients after intracranial surgery/traumatic brain injury. Cognitive impairment disrupts a variety of cognitive functions as planning, attention, concentration and problem solving.

Study results of **Dhandapani et al. (2016)** mentioned that patients with intracranial tumors had substantial cognitive impairment and there was no significant improvement in cognitive function after intracranial surgery till 6 months. After 6 months of intracranial surgery patients showed improvement in cognitive function.

Cognitive impairment may impair motor function of patients which includes: problems with attention, memory, initiation, comprehension, perception and/or psychomotor delay. Causes of cognitive impairment may include the following: direct effects of brain tumor, surgical resection, medical treatment, fatigue and/or anxiety. This interferes with attention and concentration of patients with brain tumor **(Khan et al., 2014)**.

Meanwhile, the current study finding revealed statistical significant improved in cognitive function mean scores (attention) measured by MMSE was found among patients in rehabilitation group compared to patients in control group before discharge, 1 month and 3 months postoperatively at follow up.

From the researchers opinions this could be due to the effect of the early rehabilitation program for the patients in rehabilitation group. Although, both groups showed improvement in attention but rehabilitation group who performed the attention and concentration exercises and committed to the early rehabilitation program showed significant improvement in attention than control group. In addition to the attention and concentration exercises, implementing the following strategies showed beneficial effect as keeping adequate room lighting and visible signage, clock in patient room, open shades during the daytime, reminders on date and time and regular visits from family/friends. Also, saying good morning/good afternoon or good night and patient name, introducing self, and encouraging family members to bring in familiar objects/ pictures. All these strategies helped the patients in rehabilitation group to gain more attention and concentration.

Study result of **Yu et al. (2019)** supported the result of the present study which reported that patients with brain tumor showed impairment in cognitive function measured by MMSE before and after brain surgery. Also, their study results reported that significant improvement in cognitive function measured by MMSE was observed after rehabilitation for patients after resection of brain tumor.

This present study finding found that no statistical significant difference was found between rehabilitation and control groups as regard impairment in balance at assessment baseline; preoperative and immediate postoperative after craniotomy. In the same line, the study result of **Yu et al. (2019)** identified that patients with brain tumor showed impairment in motor function; balance measured by BBS at the time of assessment before rehabilitation.

According to study of **Kushner & Amidei, (2015)** motor dysfunction in patients with primary brain tumor are common and led to mobility impairment and impairment in activities of daily living, risk for potential complications of immobility and falls, anxiety and/or loss of functional independence.

Meanwhile, the current study result revealed statistical significant improved mean scores of patients balance measured by BBS was found in rehabilitation group compared to control group before discharge, 1 month and 3 months postoperatively at follow up.

From the researchers opinions, this could be due to the effect of the early rehabilitation program for the patients in rehabilitation group. Although, both groups showed improvement in balance but rehabilitation group who performed the core and balance exercises for brain rehabilitation and committed to the early rehabilitation program showed significant improvement in balance than control group. In addition to the core and balance exercises, implementing the following strategies for maintain early mobilization and socialization showed beneficial effect as working with physical therapists and neurosurgeons to devise mobilization program to be used on the nursing unit based on patients` needs and capabilities. Also, beginning mobilization in or out of bed within 24 to 48 hours following craniotomy, allowing patients to walk independently as soon as possible, engaging patients in conversation while movement, and encouraging patients to talk while walking in corridor. All these strategies helped the patients in rehabilitation group to gain balance.

In the same line, study result of **Yu et al. (2019)** reported that significant improvement in motor function; balance measured by BBS was observed after rehabilitation of patients after resection of brain tumor.

The results of the present study illustrated greater satisfaction and positive opinions of patients towards overall early rehabilitation program and improvement in attention, balance and thus in activities of daily living. Also, patients were satisfied with intensity of

the early rehabilitation program and recommend early rehabilitation program to other patients.

This current study result was supported by study result of **Yu et al. (2019)** who stated that postoperative rehabilitation is beneficial and necessary for patients with brain tumor and after brain tumor resection. Rehabilitation after brain tumor surgery showed significant short-term improvements in motor function, cognitive function and activities of daily living. The majority of them were satisfied with improvements in motor function, cognitive function, activities of daily living, intensity of the rehabilitation and recommend rehabilitation to other patients.

Nurses should initiate rehabilitation as soon as possible after craniotomy. Early rehabilitation is beneficial in preventing complications of immobility, improving motor function, cognitive function and the overall functional independence for patients with brain tumor **(Kushner & Amidei, 2015)**.

Conclusion

Patients who received early rehabilitation program following craniotomy achieved significantly less length of hospital stay, improvements in attention and balance mean scores and expressed a high degree of satisfaction. These study findings support the research hypothesis.

Recommendations:

1. Early rehabilitation studies are needed for brain tumor patients who managed by craniotomy and suffered from impaired attention and balance to clarify best practices, type, intensity and duration of rehabilitation.
2. Nurses should initiate rehabilitation as soon as possible after craniotomy to improve motor and cognitive functions and enhance patients overall functional independence level.

References

- **Abdelmowla R., Essa A., & Abdelmaged E., (2017):** Role of the nurse in preventing or reducing increase intracranial pressure following craniotomy. International Journal of Advanced Nursing Studies, 6 (2) 92-98
- **Abu-Hegazy M. & El-Hadaad H., (2016):** Neurocognitive effects of primary brain tumors. Neurooncology—Newer Developments. InTech, 241-265.
- **Alashram A., Annino G., Raju M., & Padua E., (2020):** Effects of physical therapy interventions on balance ability in people with traumatic brain injury: A systematic review. NeuroRehabilitation, 46(4), 455-466.
- **Assiut University Hospital Record (2020):** Neurosurgery Department, Neurological, Psychiatric and Neurosurgery Assiut University Hospital.
- **Berg K., Wood-Dauphinee S., Williams J.I., & Gayton D., (1989):** Measuring balance in the elderly: preliminary development of an instrument. Physiotherapy Canada, 41(6), 304-311.
- **Church C., (2020):** Core and Balance Exercises for Brain Injury Rehabilitation, Electronic book, Flint Rehab., 9-11.
- **Dhandapani M., Gupta S., Mohanty M., Gupta S. & Dhandapani S., (2016):** Trends in cognitive dysfunction following surgery for intracranial tumors. Surgical neurology international, 7(Suppl 7), S190.
- **Folstein M.F., Folstein S.E., & McHugh P.R., (1975):** "Mini-mental state: A practical method for grading the cognitive state of patients for the clinician." J Psychiatr Res; 12:189-198.
- **Freire, F.R., Coelho, F., Lacerda, J.R., Silva, M.F.D., Gonçalves, V.T., Machado, S., Velasques, B., Ribeiro, P., Basile, L.F.H., Oliveira, A.M.P. & Paiva, W.S., (2011):** Cognitive rehabilitation following traumatic brain injury, Dementia and neuropsychologia, 5, 17-25.
- **Guerra M., Singh P., & Taylor N., (2015):** Early mobilization of patients who have had a hip or knee joint replacement reduces length of stay in hospital: a systematic review. Clinical rehabilitation, 29(9), 844-854.
- **Khan F., Amatya B., Physio B., Drummond K., & Galea M., (2014):** Effectiveness of integrated multidisciplinary rehabilitation in primary brain cancer survivors in an Australian community cohort: a controlled clinical trial. Journal of rehabilitation medicine, 46(8), 754-760.
- **Krivosheya D., Prabhu S.S., Weinberg J.S., & Sawaya R., (2016):** Technical principles in gliomasurgery and preoperative considerations. JNeurooncol.; 130(2):243-252.
- **Kushner D., & Amidei C. (2015):** Rehabilitation of motor dysfunction in primary brain tumor patients. Neuro-oncology practice, 2(4), 185-191.
- **Li W., Gao J., Wei S., & Wang D. (2016):** Application values of clinical nursing pathway in patients with acute cerebral hemorrhage. Experimental and therapeutic medicine, 11(2), 490-494.
- **Maher C., (2020):** Attention and Concentration Exercises for Brain Injury Rehabilitation, Electronic book, Flint Rehab.
- **Singh A., Kumar R., Singh N., Yadav R., & Kumar A. (2021):** Evaluation of cognitive functions in traumatic brain injury patients using mini mental state examination and clock drawing test. Asian Journal of Neurosurgery, 16(1), 99.

- **Tan A., Ashley D., López G., Malinzak M., Friedman H. & Khasraw M., (2020):** Management of glioblastoma: State of the art and future directions. CA: a cancer journal for clinicians, 70(4), 299-312.
- **Teasdale G., & Jennett B. (1974):** Assessment of coma and impaired consciousness: a practical scale. The Lancet, 304(7872), 81-84.
- **Trivedi, V., Thakur, K., Choudhary, R., & Sahay, P., (2014):** Effect of strength and balance intervention in improving balance, gait and function in traumatic brain injury: A case report, Int J Health Sci Res, 4, 259-66.
- **Xu G., Li W., Liu K., Wu W., Lu W., Zhang J. F., & Wang M., (2014):** Early pressure dressing for the prevention of subdural effusion secondary to decompressive craniectomy in patients with severe traumatic brain injury. Journal of Craniofacial Surgery, 25(5), 1836-1839.
- **Yu J., Jung Y., Park J., Kim J., Suh M., Cho K. G., & Kim M. (2019):** Intensive rehabilitation therapy following brain tumor surgery: a pilot study of effectiveness and long-term satisfaction. Annals of rehabilitation medicine, 43(2), 129.
- **Zetterling M., Elf K., Semnic R., Latini F., & Engström E. (2020):** Time course of neurological deficits after surgery for primary brain tumours. Acta Neurochirurgica, 162(12), 3005-3018.
- **Zucchella C., Capone A., & Codella V., (2013):** Cognitive rehabilitation for early post-surgery inpatients affected by primary brain tumor: a randomized, controlled trial. J Neurooncol.; 114(1):93–100