Effect of pre Rehabilitation Program on Cognitive and Motor Functions for Patients Post Craniotomy

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Abstract

Background: Functional, behavioral, and cognitive disabilities often contribute to the difficulties in rehabilitation programs of victims with post-craniotomy. **Aim:** Determine the effect of the pre rehabilitation program on cognitive and motor functions for patients post-craniotomy. **Subjects and Methods:** Quasi-experimental research design was used**. Setting:** This study was carried out at the neurosurgery department and neurosurgery outpatients' clinic at Mansoura University Hospital. A convenient sample of 70 oriented patients post craniotomy was classified into the study (who received a rehabilitation program and the control group (35 in each group). **Tools:** (I) Patients' assessment sheet post craniotomy, Tool (II): Patients' knowledge, regarding craniotomy (pre and post-test), Tool (III): Patients' reporting practice regarding post craniotomy exercise (IV) Mini–mental state examination (MMSE), and (V) Berg balance scale(PBS). **Results:** In comparison to patients in the control group, participants in the pre-rehabilitation group showed a statistically significant increase in their knowledge**,** practice**,** motor, and cognitive abilities following pre rehabilitation programme (p. value < 0.01). **Conclusion:** When a pre-rehabilitation program is implemented, patients' knowledge, practice, and motor and cognitive abilities after a craniotomy significantly improve. **Recommendation:** All patients who have had a craniotomy should participate in a pre-rehabilitation program.

Keywords: Craniotomy, cognitive and motor functions & Pre-rehabilitation program

Introduction:

Significant morbidity and death are still associated with primary brain tumors, despite advancements in their care. Maximal tumor excision, followed by adjuvant chemotherapy or radiation, is currently the standard care for patients who are newly diagnosed with brain tumors (**Tan et al., 2020**). For the removal of brain tumors, craniotomies are the most often performed surgical operation. The brain is accessed during a surgical procedure that involves removing a bone flap from the skull. Following a craniotomy, patients should have regular and comprehensive nursing assessments. These assessments should concentrate on the possibility of neurological impairment due to an effusion, hematoma, seizure, hydrocephalus, or prolonged hypertension **(Xu et al., 2020)**.

Because brain tumors are infiltrative and have a short postoperative course that is frequently complicated with major adverse events, which cause an extended hospital stay, reoperation, and readmission, striking a balance between the maximal resection of the brain tumors and the preservation of neurological function can be difficult (**Krivosheya et al., 2020**). Postoperative neurological deficits sometimes have unclear causes, and it can be challenging to forecast how quickly function will decrease. Preoperative evaluation can provide more accurate information about the results of surgery after surgery **(Zetterling et al., 2020)**.

Following a craniotomy, many patients have some degree of physical or cognitive abnormalities. Patients become more easily distracted and have slower processing speeds for information. There can be variable effects on cognitive processes like memory, focus, and attentiveness as well as fatigue. During their recuperation, a lot of patients have lightheadedness and imbalance issues. Impaired balance might limit a patient's ability to participate in social activities and daily living activities. Establishing the degree of cognitive and physical impairments is essential to creating an appropriate rehabilitation strategy **(Abu-Hegazy & El-Hadaad, 2019 & Alashram et al., 2020)**.

It is possible to treat those symptoms with cognitive and physical rehabilitation. After a craniotomy, neurosurgery nurses play a proactive and useful part in their patients' rehabilitation. Important methods for providing care for patients after a craniotomy are rehabilitation and nurse administration. According to **Li et al., (2019**), it can lower the rate of disability and enhance patients' mental health and quality of life. Restoring independence is the main goal of rehabilitation after intracranial surgery to remove a brain tumor, with a focus on mobility, daily activities of living, cognition, and communication. The rehabilitation objectives change based on the issues that patients face. Early rehabilitation is necessary to accomplish the set objectives, avoid difficulties, and produce better results **(Yu et al., 2019)**.

Significance of the study

The literature indicates that patients treated with a craniotomy to remove a brain tumor frequently experience balance and attention problems. Deficits in equilibrium and focus may limit the patient's ability to do daily tasks and engage in social interactions. The prevalence of brain tumors in Africa countries has been estimated to be 226.98 /100,000 population. There is a significant difference in the distribution of CNS tumors across Africa, with Nigeria having the highest number of cases, followed by Egypt **(Aderinto et al., 2023).** The impact of pre-rehabilitation on balance and attention after craniotomy for brain tumor removal has not been extensively studied up to this point, so the purpose of this study was to enhance the cognitive and motor abilities of patients who had had craniotomies. 210 people were admitted to the neurosurgery department and treated with craniotomies, according to hospital data at the Neurological, Psychiatric, and Neurosurgery Association University Hospital for one year **(Mansoura University Hospital Record, 2020)**.

Operational Definitions

Cognitive function: is a broad term that refers to involved in acquisition, information manipulation, and knowledge gain. The domains of perception, memory, learning, attention, decision-making, and language skills are all included in cognitive functioning **(Fujishiro et al., 2019).**

Motor function and motor skills: motor function is the ability to learn and demonstrate the skillful and efficient assumption, maintenance, modification, and control of voluntary postures and movement patterns **(Al-Yahya et al., 2019).**

Aims of the study:

Determine the effect of the rehabilitation program on cognitive and motor functions for patients post-craniotomy through:

- Assessing patients' knowledge regarding craniotomy.
- Defining patients' practices regarding craniotomy.
- Assessing patients' cognitive and motor functions pre and post craniotomy
- Designing and implementing a pre rehabilitation program according to patients' needs.
- Evaluating the effect of a pre rehabilitation program regarding craniotomy on patients' knowledge, practices, cognitive and motor functions.
- Assessing the relationship between patients' knowledge and practice about craniotomy and their personal data.

- Finding out the correlation between knowledge and practice among patients' post-craniotomy

Research Hypothesis

H1: H1: Patients' knowledge levels are expected to improve post a pre rehabilitation program in the rehabilitation group than in the control group.

H2: Patients' practice levels are expected to improve post- a pre rehabilitation program in the rehabilitation group than in the control group.

H3: Patients' cognitive and motor functions are expected to be improved post- a pre rehabilitation program in the rehabilitation group than in the control group.

Subjects & Methods

The researchers utilized a quasi-experimental design to carry out their study.

Setting:

The study took place at the neurosurgery department and neurosurgery outpatients' clinic at Mansoura University Hospital

Sample

A purposive sample of 70 oriented patients post craniotomy was classified into two groups (35 in each group) the study or the rehabilitation group (which received the rehabilitation program) and the control group (which received routine care) was chosen to participate in the study for six months before the craniotomy, after the surgery, before the patient was discharged, and two months after the procedure, cognitive and motor abilities were evaluated.

Sample calculation:

The number of participants was calculated based on the following formula (https:// byjus. com/ sample- size-formula/).

$$n = \frac{T^2 \times p(1-p)}{m^2}$$

Description:

n = required sample size.

t = confidence level at 95% (standard value of 1.96).

p = estimated prevalence of patients post craniotomy 2018 at CUSPH =0.76)

m = margin of error at 5% (standard value of 0.05).

<u>Inclusion Criteria</u>

- Age 18- 65 years old
- Newly admitted patients
- Patient who not receiving rehabilitation program me from the hospital
- Conscious patient who oriented to place person, time
- Patients who accept in study participation

<u>Exclusion Criteria</u>

- Patients with memory problems, dementia, epilepsy aphasia
- Disturbed conscious level

Tools:

Tool I: Patient assessment sheet post craniotomy:

It included two parts:

- **Part (1):** It was used to assess patients` demographic data such as age, education, residence, and occupation.
- **Part (II): Medical history:** To determine the type of brain tumor, diagnostic investigations, duration of hospital stay, and

Level of consciousness(GCS) was employed **(Teasdale & Jennette's ,1974**).

Tool (II): Patients' knowledge, regarding craniotomy (pre and post-test format): This tool was developed by the researcher based on reviewing the recent related literature (**(Zetterling et al., 2020, Xu et al., 2020, & Tan et al., 2020)**. It was developed and written in Arabic language. It is composed of open and closed-ended questions to assess patients' knowledge regarding craniotomy before and after pre rehabilitation program related to the meaning of brain surgery, meaning of craniotomy, causes for craniotomy, pre and postoperative preparations, perioperative care and warning signs/complications to be reported to the doctor, how to deal with seizure(s), knowledge related to medication prescription , dietary measures as well as knowledge related to infection control measures.

Scoring system:

The following tool was used to grade the study patients' knowledge: 0 for unknown answers, 1 for incomplete correct answers, and 2 for complete accurate answers. Every correct response, which varied depending on the question, had to be chosen by the students. Unsatisfactory knowledge was defined as less than 60% of the total knowledge score, while satisfactory knowledge was defined as more than 60% of the total knowledge score.

Tool (III): Patients' reporting practice regarding post-craniotomy exercises (pre and post-test format): This tool was developed by the researcher based on reviewing the recent related literature **(Krivosheya et al., 2020, Xu et al., 2020, & Tan et al., 2020).** It was used to evaluate patients' reporting practice after the Pre rehabilitation program post craniotomy such as pre and postoperative precautions, perioperative care, how to deal with seizure(s), prescribed medication, dietary measures, pain control, incision care, lifting, activity, driving, experience nausea and constipation.

Scoring system:

Patients who participated in the study were given scores based on their Practices: 0 for an incorrect response and 2 for a correct response. Every correct answer, which varied for every question, had to be chosen by the patients. Inadequate practices accounted for less than 60% of the total practice score, whereas adequate practices equaled or more than 60% of the total practice score.

Tool IV**: Mini–mental state examination** (**MMSE**)**:** It was adopted from **Folstein et al., (1975**). A 30-item questionnaire was utilized to evaluate the following aspects of cognitive function: language, registration (repeating named cues), attention, computation, recall, basic command following, and orientation. 30 is the total score. In terms of cognitive impairment, a score of 24–30 indicates no impairment, 19–23 indicates mild impairment, 10–18 indicates moderate impairment, and 0–17 indicates severe impairment.

Tool V**: Berg balance scale (BBS):**

It was created by **Berg et al. (1989**) to assess adults' static and dynamic balancing abilities. Through the completion of practical tasks, balance ability was assessed. The test consisted of 14 items that were split into 3 categories of functional activities: dynamic balance (5 items), standing balance (8 items), and seated balance (1 item). Every item has a five-point rating system, with 0 denoting the lowest function level and 4 the greatest function level. For every score (which can range from 0 to 56), a sum is calculated. Reduced fall risk = higher score. With a score of 0–20, balance impairment is indicated, 21–40, acceptable balance, and 41–56, good balance

Validity of the tools

Five experts in the fields of medical-surgical nursing and neurosurgery evaluated the tool's content validity, testing it for appropriateness, clarity, comprehensiveness, and relevance. These experts included two professors and two assistant professors of medical-surgical nursing staff , Mansoura University, as well as one professor of neurosurgery staff, faculty of medicine ,Mansoura university. To guarantee sentence visibility and study topic appropriateness, no changes were made to the study material.

Reliability of the used tools

The conventional criterion of a kappa statistic (k) above 0.6 was used to evaluate the reliability of GCS, which was employed in tool I. Tool II using the 0.95 correlation coefficient. Tool IV is determined by correlation coefficient (0.78) and Tool III by Cronbach's alpha test (0.98).

Method:

The Preparatory phase:

It included reviewing current, past, local, and international related literature and theoretical knowledge of various aspects of the study using books, articles, the internet, periodicals, and magazines to develop tools for data collection. The developed tools were examined by experts to test their reliability to the study.

A pilot study:

To make sure the research instruments were visible, applicable, and took the necessary amount of time to complete, it was tested on 10% (7 patients). No changes were made to the pilot study's findings. The current study sample consisted of patients who participated in the pilot study.

Ethical considerations

The scientific research ethics committee of the nursing faculty and the hospital directors of the neurosurgery department at the neurology and neurosurgery department of Mansoura University Hospital were consulted before the research was carried out. After informing the patients of the study's purpose, informed consent was acquired for them to participate. Patients were told by the researchers that participation in the study was entirely optional and that they might leave at any moment, for any reason, without having to provide a reason. They also guaranteed the privacy of their data.

Administrative phase:

An official letter of approval was obtained from the Dean of the Faculty of Nursing, Mansoura University Hospital to conduct the study after a full explanation of the study's aim. The letterinvolved an agreement to perform the study at the previously selected setting.

Fieldwork:

From the beginning of September 1st, 2023 to February 2023 data collection took place. Three days a week, the women were met by the researchers in the previously described setting, and each interview lasted roughly twenty to thirty minutes. In the initial meeting with the studied patients, the researchers gave an introduction, covered all the details of the study's goals, duration, and procedures, and obtained verbal consent. With completing the pretest during the initial meeting, the researchers provided a booklet to each participating studied patients and explained the contents of the program.

- The study was implemented throughout three phases: assessment, implementation, and evaluation.

I-Assessment phase:

Study tools I, II, III, IV, and V were used to gather baseline data, knowledge, and practices while the researchers met with the chosen patients. The MMSE scale (tool IV) and the BBS (tool V) were used to measure the cognitive and motor functions. The researchers took between ten and fifteen minutes to complete each instrument. Following surgery, the control group's patients received standard hospital care such as (neurological examination, family members were told to talk to their patients and point them in different directions to get their attention), while the rehabilitation group's patients additionally received a pre-rehabilitation program and a teaching booklet.

After surgery, patients underwent two months of follow-up.

II. Implementation Phase:

Enhancing cognitive and motor abilities in individuals with brain tumors after craniotomy was the aim of the rehabilitation. The content, intensity, and frequency of the pre-rehabilitation program are customized to meet the clinical demands of the patient. The rehabilitation group was assigned to morning and afternoon shifts, with two sessions per day (one-hour for each one).

The first session of brain rehabilitation focused on cognitive and concentration skills, while the second session focused on activities related to core and motor functions.

Under the guidance and support of the researchers, patients had received instruction and trained how to do exercises. To help patients finish their rehabilitation program correctly and successfully and maintain a faster recovery, caregivers, and family members were invited to join the sessions and receive education on the pre-rehabilitation program. Patients were directed to finish the two-month rehabilitation period by performing the exercises once a day at home under family supervision.

Pre-rehabilitation program (teaching booklet):

- Under the direction of **Freire et al., (2011); Trivedi et al., (2014); Church, (2020); Maher, (2020),** the researchers created it. It was created in Arabic to satisfy patients' demands for improving their motor and cognitive abilities after cranial surgery. Among them were the following:

- Techniques to sustain focus, orientation, and cognitive abilities.

- Techniques to sustain early socialization and mobilization.

- Exercises for attention and concentration:

The patient's capacity to pay attention and concentrate on multiple tasks at once was enhanced by these workouts. It was done once per day for two months. It consisted of the following: using your non-dominant hand, practicing fine motor skills, matching rhythms, repeating numbers and letters, sitting outside, and journaling.

Brain rehabilitation exercises involving core and balance: This improved gait and coordination. For two months, it was done once a day. Included weight shifts, sitting trunk extension, Romberg stance, calf lifts, forward punches, staggered stance, and core toe taps. Lateral trunk flexion (also known as oblique crunches) was also included. Because each activity was documented by the patient or a family member, the pre-rehabilitation program's implementation status could be verified.

III. Evaluation phase:

Patients were re-interviewed using same tools used in the pretest II III, IV, and V for assessing patients before discharge, post two months for the rehabilitation and control groups. In the outpatient neurosurgery clinic, follow-up was conducted at the 2-month follow-up mark.

Statistical analysis:

Data analysis was done using the statistical program for social sciences, version 21.0. Data on the personal and medical histories of the patients in both groups were compared using the independent t-test and chi-square test. The independent sample t-test verified the significance of the balance and attention improvements comparison between the rehabilitation and control groups. The program's overall satisfaction with gains in motor and cognitive functioning, activities of daily living, rehabilitation intensity, and recommendation of an early rehabilitation program to other patients was measured using the Chi-square test. A ($p<0.05$) for statistical significance was selected.

Results

According to **Table (1),** there was no statistically significant difference found between the patients in the rehabilitation and control groups concerning their demographic attributes (p. value > 0.05). They were, respectively, 56.2±8.87 and 54.7±9.66 years old on average. Males made up 60% and 54.28% of the group, respectively. Additionally, the rehabilitation and control groups had different educational backgrounds: 51.42% and 45.71%, respectively, had secondary education, and 80% and 68.58%, respectively, worked in offices.

Table (2) illustrated that, except for length of hospital stay (p. value<0.05), no statistically significant differences were observed between patients in the rehabilitation and control groups concerning medical data (p. value > 0.05). The rehabilitation group's patients had a shorter mean length of hospital stay [9.44±5.76 and 13.65±6.33 days, respectively] than the control group. Using the GCS, the mean scores levels of consciousness were 13.0±2.1 before surgery and 14.0±1.1 after in the study group compared to 13.0±3.0 pre and13.0±2.0 post in control group.

Figure (1): Reveals that (90.0%) and (97.0%) respectively were diagnosed with benign brain tumors among the studied patients in both rehabilitation and control groups.

Figure (2) highlighted that (60%) of the studied patients reported that the main source of knowledge regarding craniotomy was doctors.

Table (3) illustrated that a highly statistically significant difference was found between the patient**'s** knowledge regarding craniotomy between the control and rehabilitation group pre and post-(Pre rehabilitation) program implementation at (P<0.001).

Figure (3**)** shows that (12%) of the studied patients in the rehabilitation control group had a satisfactory level of knowledge regarding craniotomy in the pretest but post--(Pre rehabilitation) program implementation had improved and become (85%) .

Table (4) illustrated that a highly statistically significant difference was found regarding the patients' practices about craniotomy between control and rehabilitation groups pre and post- Pre rehabilitation program implementation at (P<0.001).

Figure (4**)** shows that (13%) of the studied patients in the control group had an adequate level of **practice** regarding craniotomy in the pretest but post-awareness program implementation (80%) had an adequate level of practice in the rehabilitation group.

Table (5): demonstrated that before discharge, one month, and two months after surgery, there was a discernible improvement in the mean score in both the rehabilitation and control groups. When compared to the control group, the rehabilitation group's improvement was, nevertheless, statistically significant (p. value < 0.01). Furthermore, there was no statistically significant difference found in the mean score for cognitive function between the patients in the two groups before surgery and immediately after surgery (p. value > 0.05).

Table (6): showed that there was a noticeable improvement in both groups' mean scores before discharge as well as one and two months after surgery. But compared to the control group, the rehabilitation group showed significantly more progress (p. value < 0.01). However, when it came to the mean score for balancing ability, there was no statistically significant difference between the patients in the rehabilitation and control groups (p. value > 0.05) during preoperative and **Immediate postoperative** Balance.

Table (7): Showed that there was a highly statistically significant correlation between the knowledge and educational level of the **patients** in the study. Additionally, there was a correlation between **patients'** residence, and practice at (P value <0 .001).

Table (8): describes that a statistically significant positive correlation was detected between the studied **patients'** total practice and knowledge post-Rehabilitation program implementation at p<0.05.

Table (1): Demographic characteristics of the studied patients in both rehabilitation and control groups

Variables		Rehabilitation Group (n=35)		Control Group (n=35)		P- value
		No.	%	No.	%	
Age (years)	Mean ± SD	56.2±8.87		54.7±9.66		0.083
Sex						
Male		21	60.0	19	54.28	0.229
Female		14	40.0	16	45.71	
Level of education						
University		4	11.42	8	22.85	0.626
Secondary		18	51.42	16	45.71	
Primary		3	8.60	4	11.42	
Read and write		4	11. 42	5	14.28	
Illiterate		6	17.10	2	5.71	
Occupation						
Not work		7	20.0	11	31.42	0.251
Office work		28	80.0	24	68.58	

Non significant p>0.05 Significant p<0.001

Table (2): Medical data distribution of the studied patients in rehabilitation and control groups

Items	Rehabilitation Group (n=35)		Control Group (n=35)		P- value
	No.	%	No.	%	
Type of brain tumor					
Benign	32	90.0	34	97.0	0.076
Malignant	3	10.0	1	3.0	
Length of hospitalization (days) (Mean ± SD)	9.44±5.76		13.65±6.33		0.03*
Level of consciousness (Mean ± SD)					
Preoperative	13.0±3.0		13.0±2.1		0.063
Postoperative	14.0±1.0		14.0±1.1		

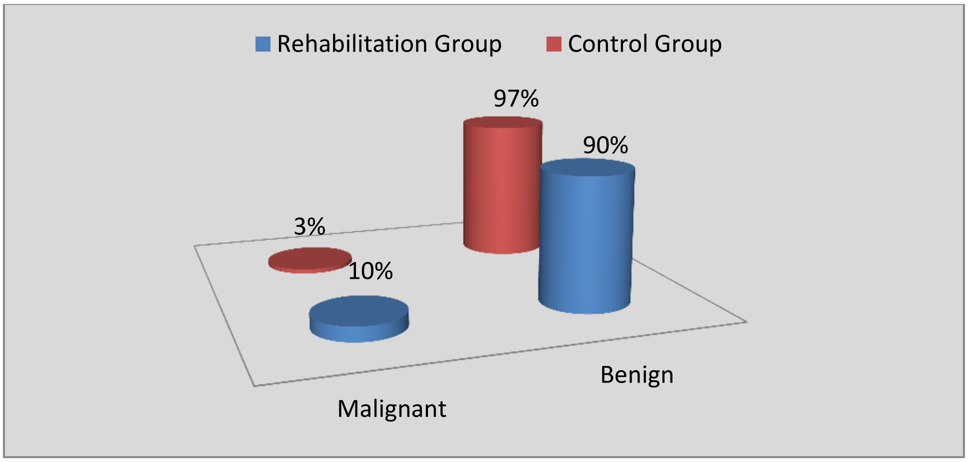

Figure (1): Distribution of the studied patients in rehabilitation and control groups regarding their brain tumor type.

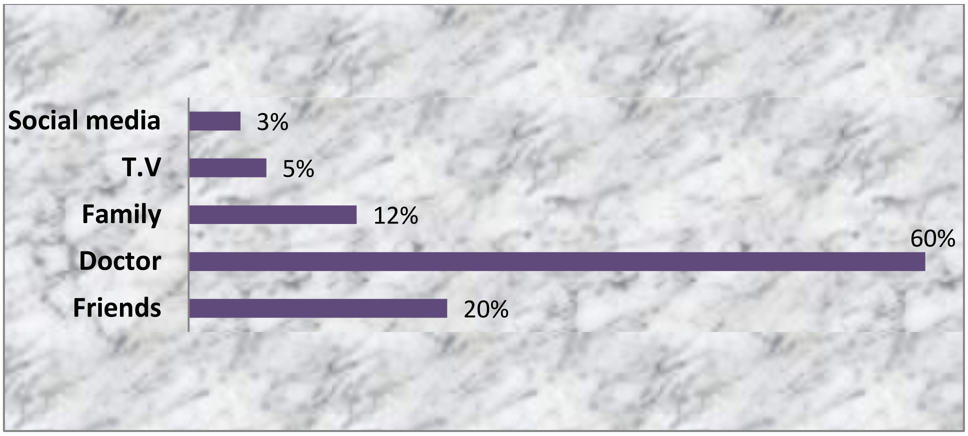

Figure (2): Source of knowledge regarding craniotomy among the studied patients (n=70)

Table (3): Patients' knowledge scores regarding craniotomy pre and post-rehabilitation program implementation (70)

Patients' knowledge	Control Group (n=35)	Rehabilitation Group (n=35)	Paired t-test	P value
Meaning of brain surgery	.47±.56	1.85±.62	20.5	<0.001**
Meaning of **craniotomy**	.75±.36	1.73±.56	31.6	<0.001**
Causes for **craniotomy**	.48±.52	1.45±.33	24.7	<0.001**
Pre and postoperative precautions	.72±.51	1.81±.45	34.8	<0.001**
Perioperative care and warning signs/complications	.54±.48	1.52±.46	11.06	<0.001**
How to deal with seizure(s)	.65±.47	1.34±.41	15.6	<0.001**
Knowledge related to prescribed medication	.54±.43	1.71±.41	25.4	<0.001**
Dietary measures	.38±.51	1.83±.31	21.8	<0.001**

P:**: Highly Statistically significant at p<0.001

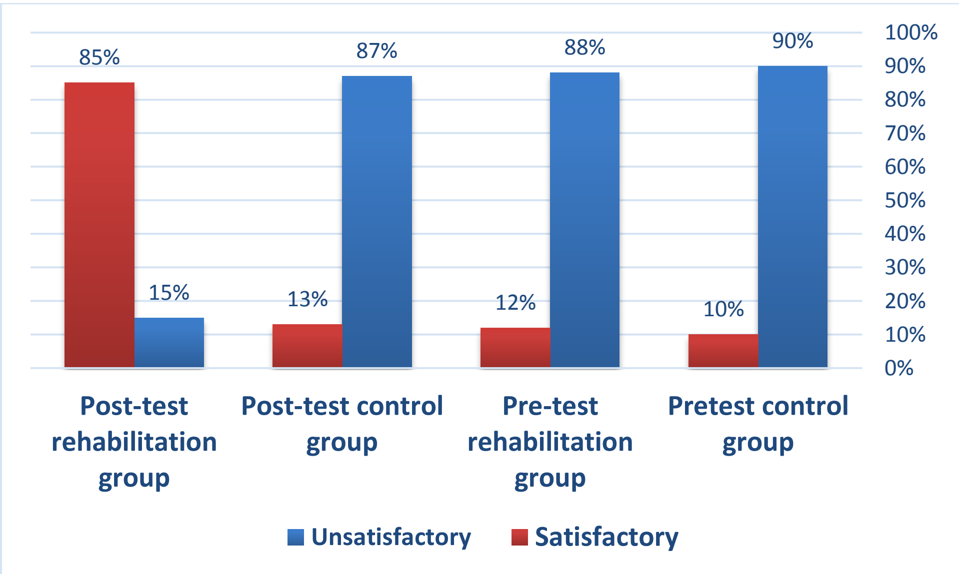

Figure (3): Total patients' knowledge level regarding craniotomy **between** control and rehabilitation groups **pre and post rehabilitation program implementation (n=70).**

Table (4) Comparison of the mean score among studied patients' practice level regarding craniotomy between control and rehabilitation groups pre and post-Rehabilitation program implementation (n=70).

Variable	Control Group (n=35)	Rehabilitation Group (n=35)	Paired t-test	P-value
	Mean ±SD	Mean ±SD		
1.Pre and postoperative precautions	.67±.34	1.32±.53	54.4	<0.001
2.Perioperative preparation	.66±.71	1.76±.48	61.9	<0.001
3. dealing with seizure(s)	.60±.58	1.87±.71	55.5	<0.001
4.Prescribed medication	.45±.57	1.86±.57	20.6	<0.001**
5.Dietary measures	.67±.32	1.32±.53	54.4	<0.001
6.Pain control	.66±.71	1.76±.48	61.9	<0.001
7.Incision care	.60±.58	1.87±.71	55.5	<0.001
8.Lifting	.45±.55	1.86±.57	20.6	<0.001**
9.Activity	.67±.32	1.32±.53	54.4	<0.001
10.Driving	.66±.76	1.76±.48	61.9	<0.001
11.experience nausea and constipation	.60±.58	1.87±.71	55.5	<0.001

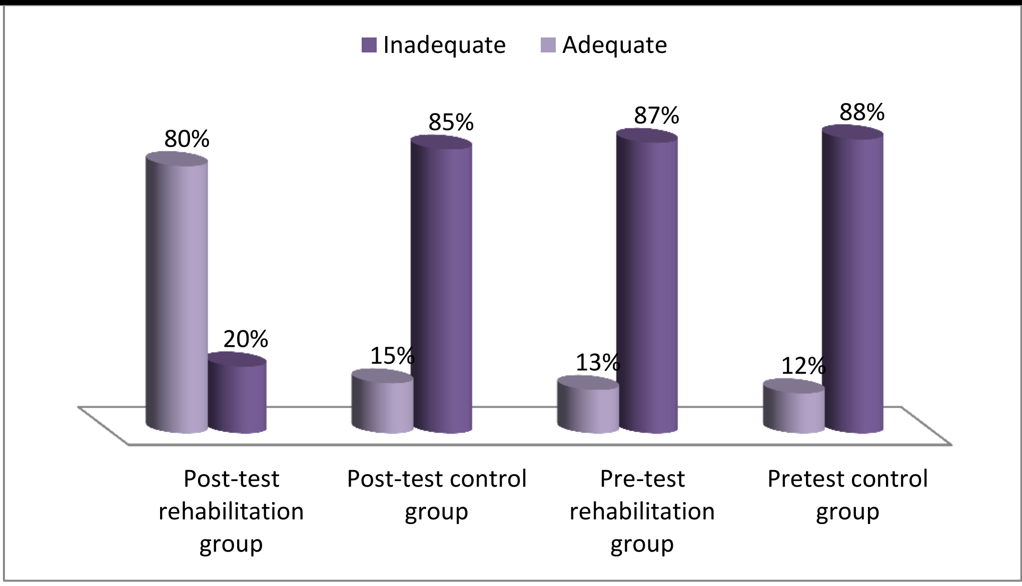

Figure (4): Total practice level regarding craniotomy pre and post- rehabilitation program implementation among the studied patients in control and rehabilitation groups **(n=70)**

Table (5): Patients cognitive function mean scores among the studied patients in both rehabilitation and control groups at different phases

Time of Evaluation	Rehabilitationgroup (n=35)	Control group(n=35)	P- value
	Mean ± SD	Mean ± SD	
Preoperative	18.4±1.8	18.3±1.7	0.245
Immediate postoperative	18.8±2.7	18.6±2.4	0.267
Before discharge	22.9±5.8	20.3±2.5	0.001**
1 month postoperatively	24.6±6.7	20.8±2.2	0.001**
2 months postoperatively	25.2±5.2	21.7±3.4	0.001**

Non significant p>0.05 Significant p<0.001

Table (6): Patients balance mean scores among the studied patients in both rehabilitation and control groups at different phases

Time of Evaluation	Rehabilitation group (n=35)		Control group(n=35)		P- value
	No.	%	No.	%	
Preoperative Balance impairment (0-20)	35	100	35	100	0.956
Mean ± SD	17.1±3.5		17.1±3.4		
Immediate postoperative Balance impairment (0-20)	35	100	35	100	0.934
Mean ± SD	17.2±3.5		17.3±3.8		
Before discharge					0.001**
Balance impairment (0-20)	-	-	1	3.0	
Acceptable balance (21-40)	35	100	34	97.0	
Good balance (41-56)	-	-	-	-	
Mean ± SD	33.5±2.6		28.4±65.8		
1 month postoperatively					0.001**
Balance impairment (0-20)	-	-	-	-	
Acceptable balance (21-40)	21	60.0	32	90.0	
Good balance (41-56)	14	40.0	3	10.0	
Mean ± SD	44.6±9.8		38.5±13.3		
2 months postoperatively					0.001**
Balance impairment (0-20)	-	-	-	-	
Acceptable balance (21-40)	3	10.0	21	60.0	
Good balance (41-56)	32	90.0	14	40.0	
Mean ± SD	46.6±9.9		42.7±9.7		

Non significant p>0.05 Significant p<0.001

Table (7): Correlation between total knowledge, practice, and their data among the patients in the study group (n= 35)

Items		Knowledge	Practice
Age	R	-.125-	-.102-
	P – value	.351	.446
Educational level	R	**-.555**	.023
	P – value	**.001****	.877
Occupation	R	.063	**-.357**
	P – value	.617	**.015***
Residence	R	.044	**-.504**
	P – value	.749	**.001****

**. Correlation is significant at the 0.01 level

Table (8): Correlation between total mean scores of knowledge and practice regarding craniotomy **among the patients in the study group pre and post- program implementation (n=35).**

Items	Practice			
	Pre- Rehabilitation program implementation		Post- Rehabilitation program implementation	
	R	P	R	P
Knowledge	0.134	0.061*	0.246	0.000**

r: Pearson coefficient. **: Highly statistical significant at P< 0.001.

Discussion

When motor and cognitive deficits manifest, many patients who have undergone intracranial surgery require early rehabilitation. Pre- rehabilitation has demonstrated benefits in improving motor and cognitive abilities in brain tumor patients, however, it is still contentious; most of these benefits have come from observational studies rather than randomized controlled trials (**Zucchella et al., 2019**).

Results of the current study revealed that there were no statistically significant differences between the patients in the rehabilitation and control groups regarding their demographic and medical data. from the researchers' point of view, it reflected the similarity of characteristics among both studied groups.

According to this study, the average age of the rehabilitation group was 56.2±8.87 years, whereas the control group's mean age was 54.7±9.66 years. The present study corroborates the findings of **Abdelmowla et al., (2017**), who investigated 124 patients following craniotomy, with a mean age of 37.5±18.5 years for the control group and 39.2±16.5 years for the study group. Males made up more than half of both studied groups, These results agree with a study by **BinMadhi, (2018**) entitled "Brain tumors excision guided by neuronavigation: Practical application and results" which revealed that brain surgery is more frequently undergone in males than females with the same mean age of years old.

Regarding the duration of hospitalization, a statistically significant difference was seen between the control and rehabilitation groups. The control group was hospitalized for a longer period than the rehabilitation group. According to the researchers, this might be because of how the patients in the rehabilitation group responded to the pre-rehabilitation program. After applying the methods for maintaining direction, attention, and concentration as well as the strategies for maintaining early mobilization and socialization, the rehabilitation group demonstrated a good improvement in attention and balance both throughout hospitalization and before discharge. Additionally, the daily physical activities performed while in the hospital under the guidance of researchers and patients' families (such as core and balance exercises and attention and concentration exercises) ultimately, help cut down on hospital stays.

The current study result indicated that pre-rehabilitation led to a decreased frequency and duration of delirium, fewer days spent in the hospital, and a higher likelihood of returning to an independent functional level upon discharge, which was corroborated by the results published by **(Guerra et al., 2019).**

The result of the current study showed that three-fifths of the studied **patients** reported that the main source of knowledge regarding craniotomy was doctors. From the researchers' point of view, this result reflects that patients had the desire to seek information from health personnel.

The result of the current study illustrated that a highly statistically significant difference was found between the patient**'s** knowledge regarding craniotomy between the control and rehabilitation group pre and post- rehabilitation program implementation. From the researchers' point of view, this result reflects the positive effect of a pre rehabilitation program, which met the studied patients' needs and provided them with sufficient knowledge.

This result corroborated the findings of the **Fan et al., (2020**) study regarding the "KAP theory" and showed that adopting the practice and obtaining the necessary knowledge alters health behavior. Furthermore, a new study by **Rana et al., (2020**) demonstrated the link between enough personal knowledge and successful illness prevention, control, and health promotion. A study by **Ricardo et al., (2018**) provided evidence that maladaptive disease and poor health are linked to a knowledge gap.

The present study findings indicated that slightly more than ten percent of the studied patients in the rehabilitation group had a satisfactory level of knowledge regarding craniotomy in the pretest but post- rehabilitation program implementation had improved and the majority in the rehabilitation group had a satisfactory level of knowledge. From the researchers" point of view, it reflected the positive effect of rehabilitation programs and illustrated the importance of introducing programs about craniotomy to patients.

The present study findings indicated that a highly statistically significant difference was found regarding the patients' practices about craniotomy between control and rehabilitation groups pre and post-awareness program implementation. From the researchers" point of view, it confirmed the positive effect of awareness program implementation and illustrated the success of the program implementation for patients.

Concerning the patients ' total scores of **practice, the current study** showed that thirteen percent of the studied patients in the rehabilitation group had an adequate level of **practice** regarding craniotomy in the pretest but the majority post- rehabilitation program implementation had an adequate level of practice in the rehabilitation group. From the researchers' point of view, it indicated the good impact of **the rehabilitation program** regarding craniotomy.

The current study's results revealed that there was no statistically significant difference between the rehabilitation and control groups regarding cognitive function impairment (attention deficit) at the preoperative and immediate postoperative stages following a craniotomy. From the researcher's point of view, it confirmed the positive effects of pre-**rehabilitation program.** According to **Singh et al., (2021)**, patients who had traumatic brain injury or intracranial surgery showed signs of cognitive impairment as measured by the MMSE. Many cognitive processes, including planning, paying attention, focusing, and solving problems, are interfered with by cognitive impairment.

According to **Dhandapani et al., (2019**) study results, individuals with intracranial tumors showed severe cognitive impairment, and following brain surgery, there was no improvement in cognitive function for six months. Following six months following intracranial surgery, patients' cognitive performance improved. Patients with cognitive impairment may experience difficulties with their attention, memory, initiation, comprehension, perception, and/or psychomotor delay, among other motor function issues. The following conditions may cause cognitive impairment: direct brain tumor effects, surgical resection, medical treatment, weariness, and/or anxiety. Patients with brain tumors find it difficult to focus and pay attention because of this **(Khan et al., 2019)**.

Patients in the rehabilitation group showed statistically significant improvements in their cognitive function mean scores (attention) as measured by the MMSE before discharge, one month after surgery, and two months after surgery at follow-up, when compared to patients in the control group. The pre-rehabilitation program's impact on the patients in the rehabilitation group may be the cause of this, according to the researchers. While attention was improved in both groups, the rehabilitation group's attention was significantly improved compared to the control group after they completed the attention and concentration exercises and committed to the early rehabilitation program.

The patients in the rehabilitation group were able to focus and pay closer attention thanks to all of these strategies. The present study's findings, which indicated that patients with brain tumors had impairment in cognitive function as measured by the MMSE both before and after brain surgery, were corroborated by **Yu et al., (2019**) .Additionally, their study's findings showed that patients' cognitive performance, as assessed by the MMSE, significantly improved following brain tumor surgery and rehabilitation.

According to the current study's findings, there was no statistically significant difference in balance impairment between the rehabilitation and control groups at the preoperative and immediate postoperative stages following a craniotomy or evaluation baseline. According to the same line, **Yu et al.,**

(2019) study result revealed that patients with brain tumors exhibited impairment in their motor function as well as their balance, as determined by the (BBS) at the time of rehabilitation assessment.

Kushner & Amidei, (2015) study indicated that motor dysfunction is frequently observed in patients with primary brain tumors. This condition can result in reduced mobility and ability to do everyday tasks, increased risk of consequences from falls and immobility, anxiety, and/or loss of functional independence. Before discharge, one month after surgery, and two months after surgery, the rehabilitation group's mean scores for patients' balance, as determined by the Balance Assessment Scale (BBS), were shown to be statistically significantly higher than those of the control group.

According to the researchers, this might be because of how the patients in the rehabilitation group responded to the pre-rehabilitation program. While balance improved in all groups, it was significantly better in the rehabilitation group—which committed to a pre-rehabilitation program and completed core and balance exercises for brain rehabilitation than in the control group. Using the following techniques to maintain pre-mobilization and socialization, in addition to core and balance exercises, proved beneficial: collaborating with physical therapists and neurosurgeons to develop a mobilization program that the nursing unit would use based on patients' needs and abilities. In addition, patients should be encouraged to communicate while moving and to start mobilizing in and out of bed within 24 to 48 hours of having a craniotomy. They should also be allowed to walk independently as soon as possible. These tactics all assisted the patients in the rehabilitation group in regaining their equilibrium. In a similar vein, **Yu et al., (2019**) study findings documented a noteworthy enhancement in motor function and balance following brain tumor surgery.

The current study's findings illustrated a statistically significant correlation between **patients'** educational level and their knowledge level; this could be because **patients** with more education had more accurate knowledge than **patients** with less education.

The current study's findings demonstrated a highly statistically significant correlation between patients' education and their knowledge levels. This could be because patients' that high in education had more accurate knowledge.

The current study's findings demonstrated that there was a highly statistically significant positive correlation between the studied **patients'** knowledge and practice post-rehabilitation program implementation. From the researchers' point of view, this reflects the importance and effectiveness of the pre-rehabilitation **program** that is commonly associated with improving knowledge and better knowledge among the studied **patients** that help them learn and acquire good knowledge and apply it. This association is explained by that when the studied **patients** had sufficient knowledge that can help them improve their practice.

The current study's findings revealed the success of the study's aim and its objectivity. The findings of **the Yu et al., (2019)** study, which indicated that pre-rehabilitation is advantageous and required for patients with brain tumors and following brain tumor surgery, corroborated the findings of the current investigation. Following brain tumor surgery, rehabilitation revealed notable short-term gains in motor function, cognitive function, and daily living activities. Most of them expressed satisfaction with gains in daily life activities, motor function, cognitive function, and rehabilitation intensity, and they recommended rehabilitation to other patients. Following a craniotomy, nurses should start rehabilitation as soon as feasible. For individuals with brain tumors, pre-rehabilitation helps to improve motor function, cognitive function, and general functional independence while preventing problems from immobility **(Kushner & Amidei, 2015)**.

Conclusion:

Based on the results of this study, the present study concluded that the implementation of a rehabilitation program has a significant positive effect on knowledge, practice, cognitive, and motor functions for patients post-craniotomy.

Recommendation:

Based on the results of this study the following recommendations are suggested:

- To enhance patients' knowledge, practice, cognitive and physical abilities following a craniotomy, an ongoing training program is required.

- Following a craniotomy, all patients should participate in a pre-rehabilitation program.

- For patients who have had a craniotomy, comprehensive printed educational materials in plain Arabic, such as booklets, pamphlets, and posters, are needed.

- It is necessary to repeat the current study with a bigger patient sample in various contexts to generalize the findings.

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