International Egyptian Journal of Nursing Sciences and Research (IEJNSR)

Original Article

The Effect of Early Designated Exercise Program on Balance, Mobility and Risk for Falling among Traumatic Brain Injury Patients

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ABSTRACT

Background: Depending on the kind of injury, its severity, and the area of the brain affected, traumatic brain injury can have a variety of health repercussions that may occasionally last for a long time or even be irreversible. **Aim**: The present study aimed to evaluate the effect of early designated exercise program on balance, mobility and risk for falling among traumatic brain injury patients. **Design**: A quasi-experimental (pre/posttest) design was used in the present study. **Settings**: The study was conducted in inpatient wards at neurological intensive care unit (ICU) and neuro-surgical unit at emergency Hospitals Mansoura University, Mansoura governorate, Egypt. **Subjects**: A purposive sample of 40 adult patients with acute traumatic brain injury (TBI). T**ools of data collection:** Data were collected using tool I: Structured patient's neurological assessment sheet; Tool II: Berg balance scale. **Results:** Severity of traumatic brain injury of studied patients has been decreased from (82.5%) for moderate degree and (7.5%) for sever cases pre implementation to (87.5%) cases with mild degree TBI post implementation. Total scores of Berg balance scale of the studied patients were improved from (39.05±7.75) pre implementation to (50.90±3.34) post implementation with highly significant difference in all items of Berg balance scale scores (<0.001). **Conclusion**: Early designated exercise program was effective to improve balance, mobility as well as reduced risk of falling among traumatic brain injury patients according to the total scores of Berg balance scale. **Recommendation**: carrying out additional research while paying close attention to offering program sessions one-on-one to patients in order to maximize program impact.

Key words: Balance, Early Designated Exercise, Mobility, Risk for Falling, Traumatic Brain Injury Patients.

Introduction

A brain injury brought on by an external force is referred to as a traumatic brain injury (TBI). TBI can result from an object entering the brain or from a violent bump, blow, or jolt to the head or body. TBI is not always the result of head trauma. Certain forms of TBI might result in short-term or transient brain issues include issues with a person's thoughts, comprehension, movements, speech, and behavior. Serious TBI can cause death as well as severe, lifelong disability. Certain injuries are regarded as primary, which denotes that the harm occurs right away. Others may be secondary, which means they may develop gradually over the course of the days, weeks, or hours following the injury. Following the initial head trauma, reactive processes lead to these subsequent brain damage (Dawodu, 2023).

Depending on the length of time lost consciousness, posttraumatic amnesia, and/or the Glasgow Coma Scale (GCS) score at the time of hospital admission, traumatic brain injury (TBI) severity is categorized as mild, moderate, or severe. One important category of possible bad outcomes is neuropsychological problems, such as decreased attention, memory, and cognitive processing efficiency, can cause substantial functional impairment and represent a major category of possible adverse TBI-related outcomes for more severe TBIs. It is less clear, though, that smaller brain lesions, independent of mental factors, result in long-term cognitive deficits or functional impairment (Mohamed et al., 2020).

The degree of the injury mostly determines the complications that may follow traumatic brain injury. Non-neurological organ failure is common following traumatic brain injury and alone increases morbidity and mortality. It's a risk factor that may be managed, and the results may be better with early identification and treatment. Among the concerns linked to immobility are infections, heart rhythm abnormalities, protein-calorie deficiency, and consequences such bedsores and multiple organ system failure are among the issues associated with hospitalization or systemic complication after TBI. After a traumatic brain injury (TBI), systemic problems may develop as a side effect of treatment or as a result of neurogenic variables such as the high catecholamine and neuro-inflammatory response linked to brain injury. nervous system problems or issues related to the nervous system (Goyal et al., 2018).

Since spontaneous neurological recovery may persist for nine to fifteen months after traumatic brain damage, time after injury is a crucial factor to take into account. Extended immobilization and bed rest during an acute period can also lead to motor impairment; prolonged immobility can affect several physiological systems that primarily affect motor performance. In order to help the patient regain their independence after a traumatic brain injury, motor rehabilitation is crucial (Dos Santos Silva Borges & Rodrigues Neto, 2020).

People's perception of their own health is also correlated with their physical work ability. Mobility difficulties and poor emotional health are linked to TBI patients' decreased occupational or physical capacity. The fundamental requirement for preserving health, wellbeing, and functioning capacity in TBI patients is the utilization of physical activity (adapted exercise). Depending on the severity of the TBI, a patient's recovery may take months or even years. Many individuals who are released still have neurological or functional problems. Patients frequently need physical, occupational, and speech therapy. The morbidity of traumatic brain injuries can be reduced by implementing a collaborative approach from several specializations. After the process of rehabilitation completed and the patient can return to a life of normality (Herrera, 2024).

Traumatic brain damage frequently results in balance disorders. Somatosensory information, which encompasses both the tactile and proprioceptive systems, must be received and integrated by the central nervous system in order to preserve equilibrium. Additionally, they are located in the feet and may be crucial for preserving balance and body stability when standing erect. Muscle spindles and Golgi tendon organs, which convey the sense of joint position and motion, are proprioceptive sensors. The feet's proprioceptive receptors can provide information regarding balance because they are sensitive to ankle rotation (Alashram et al., 2020).

Depression, a fear of falling, and a restricted capacity for social interaction have all been linked to low self-esteem in one's ability to balance. By implementing specific exercises that avoid joint stiffness and contractures, restore full range of motion, and focus on the patient's motor component to improve his balance, nurses play a significant role in managing traumatic brain injury and preventing sequelae (Romanov et al., 2021).

Significance of the study:

According to estimates from the World Health Organization, 10% of traumatic brain injuries (TBI) are moderate to severe, and 70% to 90% are mild. According to estimates, the death rate is between 30% and 50%. About 500,000 patients are hospitalized with TBI, which affects approximately two million people in Egypt annually (Hubbard & Hodge, 2016). TBI can happen at any point in a person's life and is a major cause of death and permanent impairment for people of all ages. Both acute and long-term impacts of TBI can result in diminished independence and a lower standard of living. Exercise intolerance and cardiorespiratory dysfunction are common in people with TBI, which increases their risk of chronic illnesses including cardiovascular disease. People who engage in physical activity have a lower chance of developing chronic illnesses living with disability and improve overall mood, cognition, and quality of life (Johnson et al., 2023).

People with traumatic brain injury (TBI) frequently have postural instability and balance issues. After a traumatic brain injury, 39–62% of people experience it. Longer inpatient stays are associated with declining balancing ability. Deficits in balance might limit social engagement and activities of daily living (ADLs). Balance impairments continue to be one of the most commonly documented chronic impairments for people with TBI, even if improvements in balance happen between 0 and 6 months after the injury (Alashram et al ., 2020).

So, There is an urgent need to conduct such a study to investigate balance, mobility and risk for falling among traumatic brain injury patients post early designated exercise program.

Aim of the study

The aim of the study was to evaluate the effect of early designated exercise program on balance, mobility and risk for falling among traumatic brain injury patients.

Research hypothesis

Traumatic brain injury patients who would perform early designated exercise program would exhibit improvement in their balance, mobility and reduce risk for falling post implementation of early designated exercise program.

Method

Study design:

A quasi-experimental design (pre- and post-intervention) was used in this study.

Setting

This study was performed in inpatient wards at neurological ICU and neuro-surgical unit at emergency Hospitals Mansoura University, Egypt.

Subjects:

40 adult patients who met the following criteria and had acute traumatic brain injury in the previously described setting were included in the purposive sample: Patients with mild, moderate, or severe acute traumatic brain injury who have a balance disorder attributable to the injury are between the ages of 20 and 60, male and female, and cognizant, able to engage in active or active-assistive exercise at least, and willing to take part in the study. Patients with unstable vitals and any fractures to the spine, lower limbs, or upper limbs are excluded.

Sample size:

Based on (Romanov et al., 2021), considering level of significance of 5%, and power of study of 80%, the sample size can be calculated using the following formula:

$$n = \frac{(Z\alpha/2 + Z\beta)^2 \times 2(SD)^2}{d^2}$$

where, SD = standard deviation obtained from previous study; $Z_{\alpha/2}$, for 5% this is 1.96; Z_{β}, for 80% this is 0.84 and d, for the expected difference. Therefore,

$$n = \frac{(1.96 + 0.84)^2 \times 2(7.3)^2}{(4.57)^2} = 40$$

Based on the above formula, the sample size required is 40.

Tools for data collection: Data were collected using two tools as follows;

Tool I: Structured patient's neurological assessment sheet: It was developed by the researcher after passing through an extensive, relevant, current national and international literature (Fernando& Natosha, (2022); Mohamed et al., 2020), which includes the following:

Part 1: Patient's neurological assessment questionnaire, which aims to assess the patient demographic data and clinical health status at the time of admission.

Part 2: Glasgow coma scale (GCS): A reliable instrument accurately depicted the degree of consciousness impairment in all kinds of acute medical and trauma patients. The researcher used the GCS, which was created by (Teasdale & Jennett, 1974), to evaluate the correlation between the GCS Score and the outcome, which serves as the foundation for a standard classification of acute traumatic brain injury.

Scoring system: Best eye response (E), best verbal response (V), and best motor response (M) are the three parameters that make up the Glasgow

Coma Scale. In the Glasgow Coma Scale, the response levels are "scored" from one (no response) to the typical values of four (eye-opening response), five (verbal response), and six (motor response).

The total Coma score thus has values between three and fifteen, as follows: Severe, GCS three to eight, GCS nine to twelve for Moderate cases and thirteen to fifteen for Mild GCS.

Tool II: Berg balance scale: It was a trustworthy instrument for assessing balance following traumatic brain injury and during the course of the rehabilitation process. Good balance tests can help choose the best course of treatment, evaluate patients' progress, and predict future disability and fall risk. The researcher used this tool, which was created by Berg (1992), for patients pre and post the program.

Scoring system: it comprises of fourteen items with a five-point scale, a range of zero- four

- Zero indicates the lowest level of function
- Four indicates the highest level of function
- Highest possible score = 56 Score of < 45 indicates a greater risk of falling
- Score 41-56 indicate a low fall risk
- Score 21-40 indicate a moderate fall risk
- Score 0-20 indicate a high fall risk

Content Validity:

There are five medical surgical nursing professors at Mansoura University's nursing faculty and two professors affiliated with the university's medical faculty, and the aforementioned setting revised the tool I (part 1) that the researchers had devised for content validity. Using a Likert-type scale with three options—one for disagree, two for unsure, and three for agree modifications are made as necessary. For relevance and clarity, the content validity index for each item ranged from 0.8 to 1.0.

Reliability:

- The reliability of Berg balance scale have received extensive research support. Cronbach's alphas were greater than 0.83 for stroke patients and 0.97 for elderly residents (Lusardi, 2004).

-According to Fischer etal., (2010), the Glasgow coma scale (GCS) has a reliability score Cronbach's α for the GCS (0.87).

A pilot study:

In the aforementioned context, a pilot study was conducted on 10% of the patients (4 patients) to assess feasibility, relevance, objectivity, ambiguity, and clarity. Changes were made as a result. Participants in the pilot study were not included in the study sample.

Fieldwork

From the beginning of May 2024, data were collected throughout a three-month period. Three days a week, from 9:00 AM to 2:00 PM, researchers were present in the settings stated above. The following phases of data gathering were used.

The assessment phase:

The researchers explained the purpose of the study and the elements of the tool. Additionally, it served as a manual for creating learning resources and data collection tools for the early exercise program (Booklet). Based on relevant literature, textbooks, and published guidelines, researchers created the first designated exercise booklet. The Arabic language used in the booklet is straightforward, unambiguous, and supported by figures for further explanation. It is estimated that each patient will take between 20 and 30 minutes to finish the questionnaire.

The Implementation phase:

- ✓ Initially, pre-intervention individual interviews were conducted with patients who fulfilled the inclusion criteria. Using tool I part 1, the researchers were able to interview one or two patients each day, asking them pertinent questions about their demographics and health. In order to assess the severity of traumatic brain injury, the Glasgow coma scale was used in tool I, part 2, to measure the patients' level of consciousness. Using tool II, balance, mobility, and fall risk were evaluated. Each patient's estimated time was between twenty and thirty minutes.
- ✓ Following the participants' transition to at least active assistance, the researcher gathered data and trained the study sample on the Early Designated Exercise Program.

According to the American College of Sports Medicine, exercise recommendations for people with traumatic brain injury include 20 minutes of aerobic cardiovascular physical activity at low to moderate intensity at least three to five times a week, strength training (also known as progressive resistance training), flexibility (also known as range of motion), and balance training, which consists of both static and dynamic exercises intended to help people cope with postural sway or destabilizing stimuli (Hassett et al., 2017).

- ✓ Training on Early Designated Exercise which is done in patients' rooms using several methods, including observing the researchers while performing the exercise, and then repeating the exercise after them, using smart phones that includes simple illustrated videos on how to perform the exercise. After that, the study sample was provided with an educational booklet that includes how to perform the exercises.
- ✓ Over the course of a month, patients underwent eight training sessions, twice a week, with an average session length of 30 meters. Each participant received individualized training sessions, and the researcher used straightforward language that the patients could understand during each session.
- ✓ Lastly, after implementing the exercise program, the degree of balance, mobility, and fall risk is assessed using tools I, II, and III.

Evaluation phase:

In this phase, the impact of an early exercise program on the balance, mobility, and fall risk of patients with traumatic brain injury was evaluated. The outcome was calculated by comparing the results of the same pre-intervention tools before and after the intervention.

Ethical consideration and human rights

- The Faculty of Nursing at Mansoura University's Research Scientific Ethical Committee granted ethical approval (Ref. No. P. 0586). Following an explanation of the study's purpose and nature, each participating patient gave their verbal consent before being included in the study.

- The researchers made it clear that participation is completely voluntary and that patient safety, rights, privacy, and anonymity were guaranteed from the start of the study. The information gathered will be kept private. Participants were told that their treatment and care would not be impacted if they decided to leave the study at any point.

Statistical analysis

Version 22 of the statistical package for social science (SPSS) was used to analyze the data. First, the one-sample Kolmogorov-Smirnov test was used to determine whether the data was normal. Frequent, percentage, mean, and standard deviation were among the descriptive statistical tests that were applied. When the dependent variable is normally distributed, two related samples are compared using the paired sample t-test. Additionally, the Student t test was used to compare the two groups phases. When variables are normally distributed, the Pearson correlation coefficient is used to test the relationship between them. Using Microsoft Excel, graphs were created for data visualization. When the probability of error is less than 5% ($P < 0.05$), the results are deemed significant.

Results

Table 1: illustrates that; the total (GCS) scores for the studied patients were (10.25±1.39), pre implementation of early designated exercise program improved to (13.98±1.07) post implementation with highly significant difference in all items of (GCS) scores (<0.001).

Figure 1: clarifies the severity of traumatic brain injury, the majority of studied patients (82.5%) have moderate degree and (7.5%) have sever degree of pre implementation of early designated exercise program while the majority of studied subject (87.5%) have mild degree TBI post implementation of early designated exercise program .

Table 2: demonstrates that, the total scores of Berg balance scale of the studied patients were (39.05±7.75), pre implementation of early designated exercise program improved to (50.90±3.34) post implementation with highly significant difference in all items of Berg balance scale scores (<0.001).

Figure 2: showed that the risk of fall of the studied patients, more than half (52.5%) of studied subject pre implementation and the majority (90.0%) of studied subject post implementation of early designated exercise program have low risk level of fall.

Table 3: shows that, there was a statistical significant association between Glasgow Coma Scale mean scores and marital status of the studied patients pre implementation of early designated exercise program (<0.047). Post implementation of early designated exercise program there were a statistical significant association between Glasgow Coma Scale mean scores and demographic characteristics of studied patients in educational level and marital status (<0.021 and <0.03

respectively). There also highly significant differences between Glasgow Coma Scale mean scores and the age of the studied patients (<0.009).

Table 4: explores that, there was a statistical significant association between Berg balance scale mean scores and smoking habits of the studied patients (0.032) pre implementation of early designated exercise program. Post implementation of early designated exercise program there was a statistical significant association between Berg balance scale mean scores and the age of the studied patients (0.01) . There also highly significant association between Berg balance scales mean scores and demographic characteristics of studied patients in educational level (0.008) and gander (0.002).

Table 5: represents that there was no statistically significant with positive correlation between between Berg balance scale mean scores and Glasgow Coma Scale pre and post implementation of early designated exercise program (r = 0.015 and 0.288 respectively).

Table 1: Glasgow Coma Scale (GCS) scores of the studied subject pre implementation of early designated exercise program.

Item	*Pre response*		*Post response*		*Test of significance*
	No	%	No	%	t (P)
Eye opening					
Open spontaneously	9	22.5	28	70.0	
Open to verbal command	7	17.5	12	30.0	
Open in response to pain applied to the limbs or sternum	20	50.0	0	0.0	
None	4	10.0	0	0.0	
Mean ± SD	**2.53±0.96**		**3.7±0.46**		**6.859 (<0.001)** **
Verbal					
Oriented	19	47.5	25	62.5	
Disoriented, but able to answer questions	21	52.5	15	37.5	
Inappropriate answers to questions; words discernible	0	0.0	0	0.0	
Incomprehensible speech	0	0.0	0	0.0	
None	0	0.0	0	0.0	
Mean ± SD	**3.48±0.51**		**4.63±0.49**		**9.888(<0.001)** **
Motor					
Obeys commands	3	7.5	26	65.0	
Responds to pain with purposeful movement	18	45.0	14	35.0	
Withdraws from pain stimuli	17	42.5	0	0.0	
Responds to pain with abnormal flexion (decorticate posture)	2	5.0	0	0.0	
Responds to pain with abnormal (rigid) extension (decerebrate posture)	3	7.5	0	0.0	
None	0	0.0	0	0.0	
Mean ± SD	**4.25±0.87**		**5.65±0.48**		**8.374(<0.001)** **
Total score	***10.25±1.39***		***13.98±1.07***		***14.569(<0.001)*** **

Paired sample test * statistically significant at p ≤ 0.05. ** Highly statistically significant at p ≤ 0.001

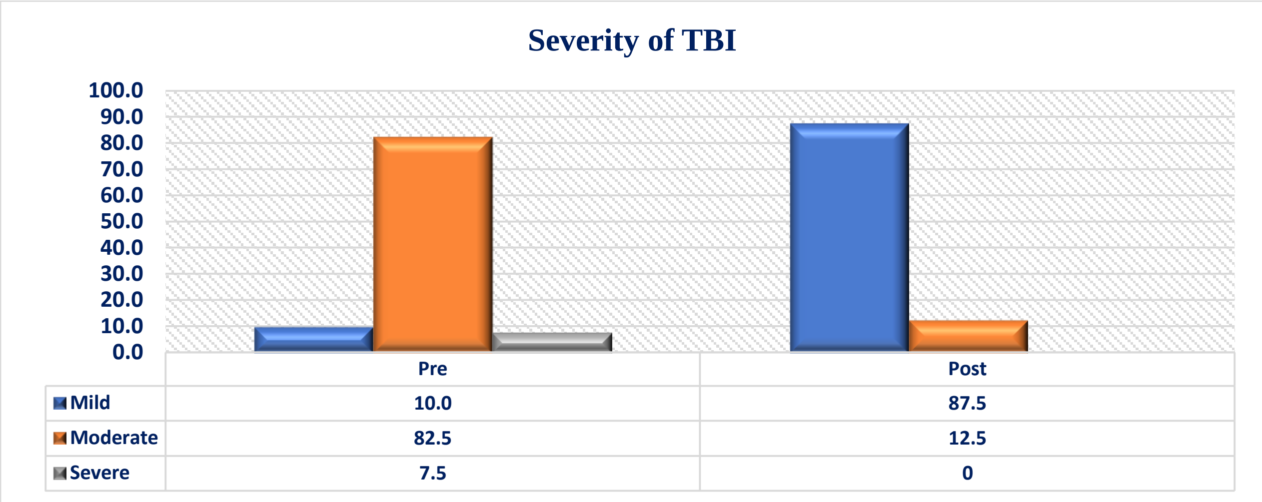

Figure 1: Severity of traumatic brain injury of the studied subject pre and post implementation of early designated exercise program.

Table 2: Mean±SD and Significant Difference of the studied subject according to Berg balance scale, Pre and Post-intervention n= (40).

Area Assessed	Pre *Mean* ± SD	Post *Mean* ± SD	Test of t (P) significance
1. Sitting to standing	3.2±0.79	3.63±0.49	2.731 (0.009) **
2. Standing unsupported	3.1±0.87	3.68±0.47	3.759 (0.001) **
3. Sitting with back unsupported but feet supported on floor or on a stool	2.9±1.1	3.63±0.49	3.760 (0.001) **
4. Standing to sitting	3.28±0.85	3.78±0.42	3.386 (0.002) **
5. Transfers	3.05±1.06	3.53±0.51	2.967 (0.005) **
6. Standing unsupported with eyes closed	2.78±0.73	3.58±0.5	5.929 (<0.001) **
7. Standing unsupported with feet together	2.98±0.66	3.78±0.42	6.670 (<0.001) **
8. Reaching forward with outstretched arm while standing	2.88±0.61	3.73±0.45	6.985 (<0.001) **
9. Pick up object from the floor from a standing position	2.88±0.65	3.63±0.49	5.648 (<0.001) **
10. Turning to look behind over left and right shoulders while standing	2.93±0.66	3.75±0.44	6.182 (<0.001) **
11. Turn 360 degrees	3.03±0.53	3.7±0.46	5.849 (<0.001) **
12. Place alternate foot on step or stool while standing unsupported	2.85±0.53	3.68±0.47	7.328 (<0.001) **
13. Standing unsupported one foot in front	2.85±0.53	3.68±0.47	7.327 (<0.001) **
14. Standing on one leg	2.45±0.55	3.80±0.41	10.642 (<0.001) **
Total scores	***39.05±7.75***	***50.90±3.34***	***7.881 (<0.001)*** **

Student t test ** Highly statistically significant at $p \leq 0.001$.

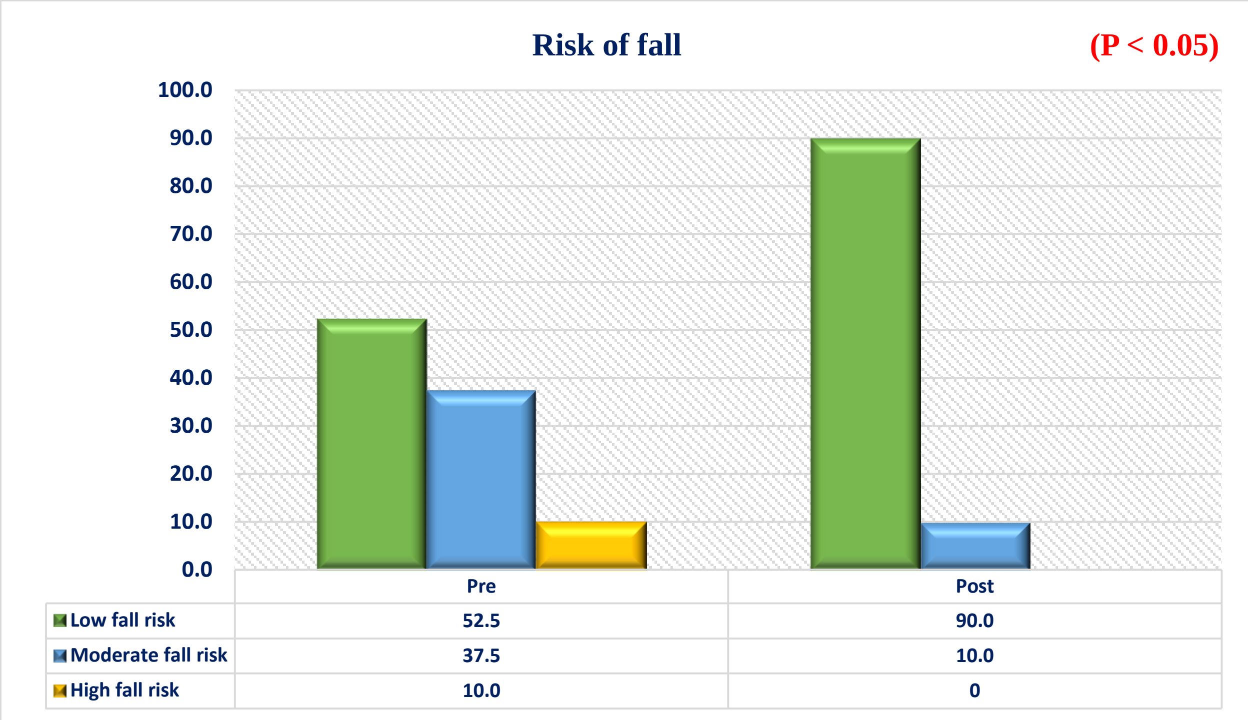

Figure 2: Risk of fall of the studied patient's pre and post implementation of early designated exercise program.

Table 3: Association between Glasgow Coma Scale mean scores (pre and post) and demographic characteristics of studied subjects.

Variable	Glasgow Coma Scale (GCS)	
	Pre	Post
Age (years)		
– 20-30	9.00±0.00	14.59±1.12
– 30-40	10.27±1.10	13.00±0.93
– 50-60	10.35±1.58	12.50±0.71
F test (P)	0.859 (0.432)	4.133 **(0.009)** **
Gender		
– Male	10.48±1.41	13.87±1.01
– Female	9.94±1.34	14.12±1.17
t test (P)	1.214 (0.232)	0.718 (0.477)
Educational level		
– Illiterate	10.25±1.36	12.58±1.06
– Basic	10.12±1.45	12.98±1.08
– Secondary	10.45±1.44	14.09±1.04
– High education	10.12±1.17	14.78±1.07
F test (P)	0.188 (0.830)	3.172 **(0.021)** *
Marital status		
– Unmarried	9.44±1.67	13.13±0.96
– Married	10.48±1.23	14.44±1.33
t test (P)	2.053 **(0.047)** *	2.726 **(0.03)** *
Living condition		
– Live alone	9.25±1.71	14.25±1.5
– With family	10.36±1.33	13.94±1.04
t test (P)	1.542 (0.131)	0.535 (0.596)
Smoking habits		
– Non-smoker	10.23±1.14	13.88±0.95
– Smoker	10.29±1.82	14.14±1.29

t test (P)	0.118 (0.907)	0.721 (0.475)
Presence of chronic medical condition		
– Hypertension	9.96±1.4	13.91±1.08
– Diabetes mellitus	10.69±1.38	14.31±1.11
– Cardiac disease	10.50±1.29	13.25±0.5
– Other	10.25±1.39	13.98±1.07
F test (P)	1.249 (0.299)	1.624 (0.211)

Sample t test F test
* statistically significant at p ≤ 0.05. ** Highly statistically significant at p ≤ 0.001.

Table 4: Association between Berg balance scale mean scores (pre and post) and demographic characteristics of studied subjects:

Variable	Berg balance scale	
	Pre	Post
Age (years)		
– 20-30	39.74±8.23	52.4±2.9
– 30-40	38.93±5.71	50.00±0.00
– 50-60	32.00±16.97	40.91±5.06
F test (P)	0.915 (0.409)	4.525 **(0.01)** *
Gender		
– Male	38.91±6.35	51.09±4.27
– Female	39.24±9.54	45.65±4.57
t test (P)	0.128 (0.899)	5.313 **(0.002)** **
Educational level		
– Illiterate	39.25±6.93	48.12±5.35
– Basic	39.88±7.79	49.82±1.72
– Secondary	37.55±9.00	50.09±4.35
– High education	39.05±7.76	52.08±4.5
F test (P)	0.298 (0.744)	4.711 **(0.008)** **
Marital status		
– Unmarried	37.44±10.22	50.89±0.93
– Married	39.52±7.02	50.09±4.94
t test (P)	0.701 (0.488)	0.009 (0.993)
Living condition		
– Live alone	37.25±12.04	52.25±1.5
– With family	39.25±7.36	50.75±4.54
t test (P)	0.484 (0.631)	0.650 (0.520)
Smoking habits		
– Non-smoker	40.96±5.23	51.04±5.31
– Smoker	35.5±10.34	50.64±1.55
t test (P)	2.230 **(0.032)** *	0.271 (0.788)
Presence of chronic medical condition		
– Hypertension	39.78±6.89	50.61±4.73
– Diabetes mellitus	36.69±9.8	50.77±4.19
– Cardiac disease	42.50±2.38	53.00±2.31
– Other	39.05±7.76	50.90±4.35
F test (P)	1.105 (0.342)	0.511 (0.604)

Sample t test F test
* statistically significant at p ≤ 0.05. ** Highly statistically significant at p ≤ 0.001.

Table 9: Association between Berg balance scale mean scores (pre and post) and Glasgow Coma Scale mean scores (pre and post) of studied subjects.

Variable		Total GCS	
		r	p
Total berg	Pre	0.015	0.925
	Post	0.288	0.071

Pearson correlation coefficient test

Discussion

Traumatic brain injury (TBI) can happen at any stage of life and is a major cause of death and permanent disability for people of all ages. Both acute and long-term effects of TBI can result in diminished independence and a lower standard of living. Among patients who have had a traumatic brain injury, balance disorders are common. Following a traumatic brain injury, this issue may last a lifetime and impact the patient's everyday activities and mobility. Early patient management during the acute phase is crucial for this. In addition to improving general mood, cognitive function, and quality of life, physical activity can lower the risk of chronic health conditions for individuals with disabilities (Johnson et al., 2023).

So, the aim of this study was to find out the effect of early designated exercise program on balance, mobility and risk for falling among traumatic brain injury patients.

Glasgow Coma Scale (GCS) was used to assess the severity of TBI, The study found that the majority of the studied subjects pre implementation of an early designated exercise program had a moderate degree of TBI, while the majority of studied subjects post implementation of an early designated exercise program had a mild degree. Also, there was a highly significant difference in GCS score of the studied subject pre- and post-implementation of the early designated exercise program. In this regard, the findings confirm with what has been found in other studies, which show a similar result emphasized that severity of TBI and GCS closely linked as GCS has ability to accurately predict patient outcome before and after TBI. Which also goes with yanna, (2024) who reported that GCS is commonly employed as a means of evaluating the level of responsiveness and providing guidance for early intervention in cases of head injury or brain dysfunction. Also the GCS scores and the change in the health status as perceived by the victim post-trauma were also positively correlated.

Also Sah et al., (2024) reported that GCS is a methodologically valid, simple, and accurate predictive instrument, the GCS works best if each of the subscales (eye, motor, and verbal) is used as a separate predictor variable and is combined with other important predictor variables. As the TBI victims after the trauma exhibited positive correlation between certain domains and the GCS results.

In this study, berg balance scale was used to assess risk for falling, balance and patients mobility. The results of the study show that, more than half of studied subject pre implementation of early designated exercise program had high risk for falling. While the majority of studied subject had low risk level of falling post implementation of early designated exercise program with statistically significant difference in between.

Snowden et al. (2023) highlighted that certain aspects of gait and balance have been closely linked in TBI survivors; higher falls risk has been demonstrated in moderate to severe TBI circumstances. In this regard, the findings are consistent with those of other studies that show similar results.

This conclusion is further supported by research by Fernando et al. (2022), which showed that a higher risk of falls is linked to worse disability and function.

Following the implementation of the early designated exercise program, the results also showed improvements in the total Berg balance scale and fall risk for the studied group. Mastrorilli et al. (2024), who demonstrated notable improvements in mobility outcomes in both groups before and after the intervention, corroborate this finding. Nonetheless, there was a notable difference in favor of the intervention group.

According to the study, most of the patients had poor balance scores before starting an early exercise program, but their balance scores significantly improved after starting the program. This is most likely a result of applying the exercises specific to the current study. These findings are consistent with other research that found similar changes in balance control in TBI patients during exercise. To enhance balance and cognition in post-traumatic brain injury patients, Johnson et al. (2023) proposed that specific exercises were just as beneficial as traditional balance training.

Furthermore, this result is in line with more recent studies by Alashram et al. (2024), who discovered that training or exercises designed to enhance sit-to-stand performance are helpful for individuals who are unable to stand up on their own following traumatic brain injury. in contrast to standard care, no treatment, or a different kind of intervention. According to Dos Santos Silva Borges & Rodrigues Neto et al. (2021), the group under study demonstrated a statistically significant improvement in their balance score, which persisted at the follow-up.

Based on the results, which show that exercise programs have been found to improve mobility in patients after traumatic brain injury (TBI), these include sitting to standing, standing unsupported, sitting with the back unsupported but the feet supported on the floor or on a stool, standing to sitting, transfers, standing unsupported with the eyes closed, standing unsupported with the feet together, using the outstretched arm to reach forward, picking up an object from the floor while standing, turning 360 degrees, standing unsupported with one foot in front, and standing on one leg.

This finding of improvement may be attributed to many factors as exercise has strengthen the core muscles, which play acritical role in maintaining stability and balance. Exercise programs improve the communication between muscles and the nervous system that enhanced coordination. Also, maintaining joint stability, which is crucial for maintaining balance.

This is comparable to the findings of Johnson et al. (2023), who found that exercise programs are useful in managing a variety of impairments after traumatic brain injury (TBI). These include motor components such as trunk muscle strengthening, tone management, balance and coordination training, and contracture prevention, as well as sensory stimulations like tactile, auditory, and visual feedback.

This explanation is also in line with the findings of a study conducted in 2024 by Alashram et al., which found that strengthening the lower limbs and core muscles helped patients become more confident and balanced when performing daily tasks. Strength and balance interventions have a positive impact on post-traumatic brain injury patients' balance, gait, and function, as well as their independence.

The results of the study showed that after the early designated exercise program was implemented. The age of the study participant and the mean scores on the Glasgow Coma Scale differed in highly significant ways. Additionally, the study demonstrated that there was a statistically significant difference between the age of the subjects and the mean scores on the Berg balance scale after the early designated exercise program was implemented.

This finding is consistent with a study by Sah et al. (2024) that found a strong correlation between changes in GCS scores and worse recovery outcomes and higher rates of surgery among older people, especially those involved in traffic accidents.

Furthermore, older people with TBI are less likely to be independent or employed, according to Downing et al. (2024). Younger people are more likely to experience anxiety, depression, and social isolation. People's ages and individual needs should be taken into account during TBI rehabilitation. According to Marina et al., (2024) BI may have two detrimental effects on aging: (1) older survivors of TBI have a harder time recovering than younger survivors; and (2) older TBI survivors are more likely to experience progressive cognitive decline.

Additionally, there are highly significant differences between the demographic characteristics of the study subjects (educational level and gander) and the mean scores of the Berg balance scale. This association is the result of instructions given to study patients using various teaching methods, such as colored booklets, lectures, and discussions. Patient adherence to instructions and educational attainment are positively related.

This explanation is consistent with the study conducted by Pranali et al. (2020), which found that the patients' overall knowledge increased following the implementation of the nursing exercise rehabilitation program.Similar results were found in research conducted by Romanov et al. (2021), which showed that patients' pre-knowledge was low or nonexistent overall, but that their post-knowledge improved statistically significantly. Last but not least, the results of the current study confirmed the study's hypotheses and demonstrated that patients with traumatic brain injury who participated in an early designated exercise program improved their mobility and balance and decreased their risk of falling.

This result is comparable to what Kanase et al. (2020) reported. whose research findings indicated that training exercises might benefit patients' everyday performance ability, which is the ultimate goal of rehabilitation, in addition to their limb function.

Conclusion

Early designated exercise program was effective to improve balance, mobility as well as lowering the risk of falling in patients with traumatic brain injury patients post implementation of program as indicated by berg balance scale scores.

Recommendations

1. To improve balance, mobility, fall risk, and everyday living activities, nurses should be encouraged to make early exercise training a regular practice for TBI patients. Furthermore, a traditional TBI rehabilitation program should incorporate exercises.

2. To ensure that the research findings can be applied to other hospitals, this study should be replicated in other clinical settings.

3. Carrying out additional research while paying close attention to offering program sessions one-on-one to patients in order to maximize program impact.

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