

ORIGINAL RESEARCH

Physiological parameters deterioration in acute stage after stroke: Rehabilitation versus conventional care

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ABSTRACT

Objective: Stroke is considered the main health problem and the second leading cause of death worldwide. Stroke resulting in varied and unpredictable complications if not managed correctly in the acute stage with intensive rehabilitation therapy which may affect stroke prognosis, and resulting functional decline. Therefore, the aim of the study was to explore the consequences of rehabilitation versus conventional care on physiological parameters during the acute stroke recovery period.

Methods: The quasi-experimental research design was used in the neurology department at Mansoura University Hospital. A convenient sample of sixty-four adult patients of both sex with stroke, who corresponded to inclusion criteria was assigned into two equal groups, study group (rehabilitation group) and control group (conventional care).

Results: The results indicates, acute phase rehabilitation limit physiological parameters deterioration during acute stroke recovery period comparing to conventional care only.

Conclusions: Acute phase stroke rehabilitation has a significant positive impact on physiological parameters.

Key Words: Physiological parameters, Acute stroke, Stroke rehabilitation, Conventional care of acute stroke

1. INTRODUCTION

Stroke is considered as one of the most significant global health issues as fifteen million people worldwide suffer from stroke annually, of these, five million are left permanently disabled.^[1] stroke is a rapidly rising problem and an essential explanation for illness and death.^[2] Stroke is also a life-changing event.^[3] It is a leading cause of adult disability and has major negative effects on the patients' lives and their families.^[4]

Stroke is caused by a disruption of the blood flow to the brain, consequential of obstruction in blood vessels, or by cerebral hemorrhage.^[5] Ischemic stroke is the most common kind of stroke, concerning eighty-seven percent of all cases affected by an ischemic stroke.^[6] Stroke affects all age groups from Twenty years old to more than sixty-five years old.^[7] The

modifiable risk factors of stroke include diabetes mellitus, hypertension, heart disease, hyperlipidemia, smoking, alcohol intake and sedentary lifestyles.^[8]

Stroke additionally has a high rate of mortality and has a vast load on the affected people.^[9] The economic burden of stroke falls on different sectors of society. Every new case of stroke represents significant costs to social care services.^[10] Deterioration and death among hospitalized patients are usually preceded by harmful changes in physiological parameters. Monitoring of vital signs is usually periodic and ward staffs are unaware of undesirable physiological changes in their patients.^[11] It is a critical to understand the relevance and the importance of physiological monitoring in acute stroke patients which includes (heart rate, blood pressure, respiratory rate, temperature, blood glucose, and oxygen level).^[12]

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Physiological monitoring is considered a fundamental component of acute stroke care. The significance of close observance throughout the first stages of post-acute stroke is recognized because of increasing alertness that the incidence of neurologic complications has been associated with clinical deterioration. Moreover, many studies have shown that hypotension, hyperglycemia, pyrexia, hypoxia, and dehydration worsen neural status after stroke.^[13] Avoid and limit current brain damage and provide the best conditions for natural brain recovery is the main focal point for stroke unit care which includes (optimal oxygenation, improve tissue perfusion, nutrition, glycemic control, and temperature homeostasis).^[14]

The patient's lives will change radically after stroke. The rehabilitation nurse is acting an important task to improve patient's condition.^[15] Stroke rehabilitation is one of the mechanisms in the treatment of stroke patients. It is typically applied by members of the multidisciplinary team, which includes doctors, nurses, physiotherapists, speech therapists, language and occupational therapists.^[16] Stroke rehabilitation is essential and should begin in the acute setting.^[17] The roles of each member in multidisciplinary team need to be coordinated to make sure of a successful consequence for stroke patients.^[18]

Nurses are the frontline healthcare providers and are always concerned in the care of stroke patients from admission until discharge.^[19,20] Stroke rehabilitation usually includes physical and mental therapy. Stroke patients are optimistic to keep on both in order to combat the harm that has been occurred in the brain.^[21]

Stroke is one of the vital areas in rehabilitation clinics as a result of it's the main cause of disability in society.^[22] Rehabilitation is an active participatory process to diminish the neurological impairment resulting from stroke. The main goal of the rehabilitation is to help patients to regain their normal physical and psychological functions and maximize recovery by providing a safe, progressive regimen that suited to the individual patient. Correct rehabilitation therapies result in enhanced motor recovery and reverse the disabilities caused by stroke.^[23,24]

1.1 Aim of study

The study aim was to explore the consequences of rehabilitation versus conventional care on Physiological parameters during the acute stroke recovery period.

1.2 Research hypothesis

The study hypothesizes that, stroke unit care including rehabilitation early after stroke helps patients to reach their maximal physiological homeostasis than those receiving conventional

care only.

2. SUBJECTS & METHODS

2.1 Study design

The Quasi-experimental research design was used in this study.

2.2 Setting

The study was conducted in the neurology department at Mansoura University Hospital.

2.3 Subjects

A convenient sample of Sixty four adult patients of both sex with cerebral stroke admitted to the neurology department were included in the study. The representative sample size was calculated using epidemiological information (EPI info.) program version 6.02 after taking into consideration the total number of cerebral stroke patients admitted to the neurological department at Mansoura university hospital.

The study subjects were assigned to the study group (receive rehabilitation after one week) and control group (receive conventional nursing care & after one month rehabilitation care was implemented to the participants in the control group), 32 each. The chosen patients were blindly distributed between both groups by using the random method.

The patients were selected according to the following criteria.

2.3.1 Inclusion criteria

Sample of either sex, aged from 20 to 65 years old, medically stable and fit for a rehabilitation program, have the ability to learn, willing to participate in the study, and newly admitted to the stroke unit.

2.3.2 Exclusion criteria

Patients with traumatic brain injury, chronic disabling pathologies (ie, severe Parkinson's disease; polyneuropathy; severe cardiac, liver, or renal failure, and cancer), and unconscious patients were excluded from the study.

2.4 Data collection tools

The following tools will be utilized to collect data.

Tool 1: Patient's assessment sheet

To collect data about patient's demographic characteristics, and necessary data about patient's general health condition.

Tool 2: National Institute of Health Stroke Scale (NIHSS)

The National Institutes of Health Stroke Scale or NIH Stroke Scale (NIHSS) is a physical deficit rating instrument that monitor neurological improvement or neurological worsening which caused by a stroke. It composed of 15 items,

each score from 0 to 4. For each item, a score of 0 indicates a normal function, while a higher score indicates some level of impairment.^[25] The individual scores from each item are summed in order to calculate a patient's total score. The maximum score is 42, with the minimum score being a zero.^[26,27] zero as normal, 1-4 minor stroke, 5-15 moderate stroke, 16-20 moderate to a severe stroke and 21-42 severe stroke.

Tool 3: Physiological Parameters Sheet

Several aspects of physiological parameters (blood pressure, pulse, respiration, body temperature, blood glucose, and oxygen saturation).

2.5 Methods

Content validity: Tools were tested by five expertises within the field of the study and therefore the necessary modification was done.

Pilot study: A pilot study was carried out on ten patients out of the sample from each group after explaining the purpose of the study to check and ensure clarity and applicability of the tools.

Reliability: Reliability was done using Cronbach's alpha, showed high reliability of the tool (Alpha = .87).

2.6 Ethical consideration

Once getting the ethical approval from Mansoura University Faculty of Nursing Ethical Committee. Official written permission was obtained by the researcher from responsible authorities. The researchers introduced themselves to all participants and explain the aim of the study to get their written consent. Confidentiality of information was assured.

2.7 Program

Preparatory phase:

- Patient's reports in the study and the control group were revised by the researcher to confirm the diagnosis.
- Each patient (both control group and study group) were interviewed individually before applying for the planned rehabilitation program in order to collect the baseline patient's data using the study tools.
- Patient's neurological condition were assessed using the National Institute of Health stroke scale (NIHSS) at the first admission day, reassessment was done after 1st month.
- Patient's physiological parameters (Temp, Pulse, Respiration, Bl.p, Blood Glucose, and O₂ saturation from affected and non affected sides) were obtained daily for one month.

Implementation phase:

- The conventional nursing care was performed to the study group by nursing staff plus rehabilitation care.

- Conventional nursing care was provided for patients in the control group by staff nurses without rehabilitation team interference at the first month which includes (oral hygiene, nasogastric feeding, improving mobility, changing positions, enhancing self-care, assisting with nutrition, bowel and bladder care, and skin care) after one month rehabilitation care were implemented to the participants in the control group but the findings didn't include in the study results.

- Nurses collected the patient profile and characteristics, assessed family history and sociocultural status, helped establish doctor-patient relationship, and guided patients in establishing approved dietary habits. According to specific conditions of the patients, nurses selected an appropriate diet and patient positioning at mealtimes. Moreover, monitored patients for physiological indicators, and assisted with psychological counseling.^[28]

- Stroke patients received rehabilitation care through an individualized treatment plan, a minimum of 30 min per session, 2 to 3 sessions per day, for 5 days per week based on individual needs and tolerance.

- Rehabilitation care conducted by the rehabilitation team after one week when the patient becomes stable (Stable vital signs for 24 hours, No chest pain within the previous 24 hours, No significant arrhythmia, No evidence of deep vein thrombosis (DVT)).

- Rehabilitation care includes[physiological monitoring, positioning, joint and limb protection, early recognition, assessment and management of dysphagia, assessment and management of tissue viability, prevention of complications (e.g. aspiration pneumonia, DVT, constipation, hospital-acquired infections), assessment for risk and prevent it (e.g. falls), management of urinary problems, early education for patient and family, concordance with secondary prevention measures, medication management and self-medication program, ensuring the patient has adequate rest and sleep, psychological support to minimize trauma, and onward referral to a specialist setting.^[29]

2.8 Statistical analysis

The statistical analysis of data was done by using the Statistical Package of Social Science "SPSS" software version 23.0. The results obtained were interpreted and descriptive statistics Means \pm standard deviations (SD) were obtained for the continuous variables. The quantitative data were presented as numbers, percentages. The paired *t*-test was used to compare data of patients before and after rehabilitation. The *p* value of $< .05$ indicates a significant result.

3. RESULTS

Table 1 shows the demographic data of the study and control groups. It shows that the mean age of the study and control

groups was 54.8 ± 8.1 and 55.3 ± 8.1 respectively. As regards to gender, male more presented in the studied sample. The majority of the two groups were married, read and write were prevailing among the two groups.

Table 1. Demographic data of the studied groups

Demographic Data	Group				Test (p)
	Study (N = 32)		Control (N = 32)		
	No	%	No	%	
Age					
30 ≤ 40	2	6.2	3	9.3	$\chi^2 = 2.2$ (.327)
41 ≤ 50	7	21.9	7	21.9	$T = 0.35$ (.731)
51 ≤ 65	23	71.9	22	68.8	
Mean ± SD	54.8 ± 8.1		55.3 ± 8.1		
Sex					
Male	19	59.4	21	65.6	$\chi^2 = 0.16$ (.687)
Female	13	40.6	11	34.4	
Marital status					
Single	3	9.4	2	6.3	$\chi^2 = 6.0$ (.047*)
Married	21	65.6	17	53.1	
Others	8	25	13	40.6	
Education					
Read & write	22	68.8	19	59.4	$\chi^2 = 3.4$ (.338)
Secondary school	5	15.6	3	9.3	
Associate degree	5	15.6	8	25	
Baccalaureate degree & above	0	0.0	2	6.3	

Note. χ^2 : Chi-square test; p value based on Mont Carlo exact probability; *p < .05.

Table 2 shows the distribution of the study and control group according to their health related data. Regarding present medical history, it was noticed that, ischemic stroke was the most common diagnosis among study and control groups (90.6% and 84.4% respectively). More than half were left side hemiplegia.

Table 2. Health related data of the studied sample

Present medical history	Group				Test (p)
	Study (N = 32)		Control (N = 32)		
	No	%	No	%	
Diagnosis					
Ischemic	29	90.6	27	84.4	$\chi^2 = 0.44$ (.505)
Hemorrhagic	3	9.4	5	15.6	
Affected Side					
Rt	13	40.6	10	31.3	$\chi^2 = 0.04$ (.839)
Lt	19	59.4	22	68.7	

Note. χ^2 : Chi-square test; p value based on Mont Carlo exact probability;

*p < .05.

Table 3 and Figures 1-6 reflect a comparison between studied groups regarding to the mean differences of physiological parameters during the study period.

Table 3. Comparison between study and control groups regarding the mean differences of physiological parameters through the study period

Physiological parameters	Group				t	p
	Study		Control			
	Mean	SD	Mean	SD		
Temperature						
Begin	37.5	0.5	37.4	0.5	1.2	.236
End	37.2	0.3	37.9	0.4	0.93	.346
Pulse						
Begin	89.4	14.6	89.6	15.4	0.31	.747
End	86.0	5.6	87.3	9.8	0.83	.406
Respiration						
Begin	23.2	6.9	23.9	6.2	0.19	.842
End	19.6	3.5	21.5	4.3	3.3	.003*
Systolic Bl. P						
Begin	143.9	29.5	158.8	36.6	1.9	.054
End	135.8	17.7	130.0	19.0	0.49	.632
Diastolic Bl. P						
Begin	89.2	14.9	94.8	16.9	1.1	.251
End	78.9	11.7	83.2	11.7	0.98	.317
Bl. Glucose						
Begin	200.5	88.9	214.6	99.4	0.75	.467
End	162.2	36.1	178.8	50.3	2.3	.029*
O₂ affected						
Begin	93.2	4.2	92.9	4.2	0.66	.518
End	96.5	1.4	95.7	2.1	1.2	.232
O₂ non affected						
Begin	96.6	1.8	95.9	2.5	1.8	.064
End	97.6	1.2	97.5	1.2	0.51	.608

*p < .05.

The physiological parameters including temperature, pulse, respiration, blood pressure, blood glucose, and O₂ saturation. As regards the mean differences of body temperature measurements during the study period among the studied groups, it can be noted that the mean body temperature measurements decreases constantly and go within normal range through the

study period for study (rehabilitation) group, for the control group, shows fluctuation and deviation from normal for the first 3rd and 4th weeks (see Figure 1). In relation to mean pulse, it is observed that there was no statistical significant difference between the studied groups (see Figure 2).

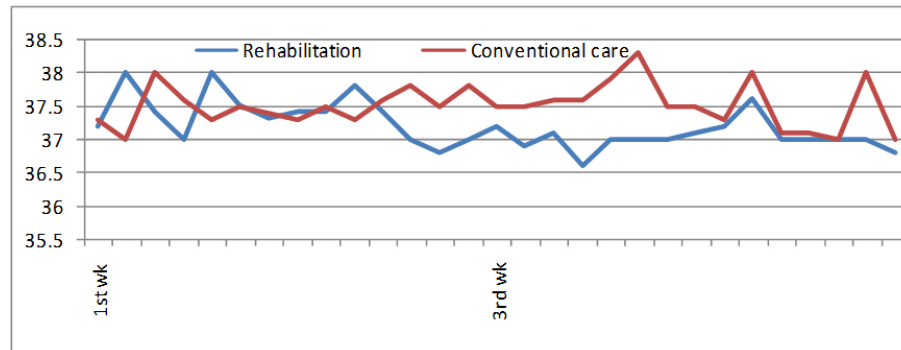


Figure 1. Mean body temperature among the study and control group

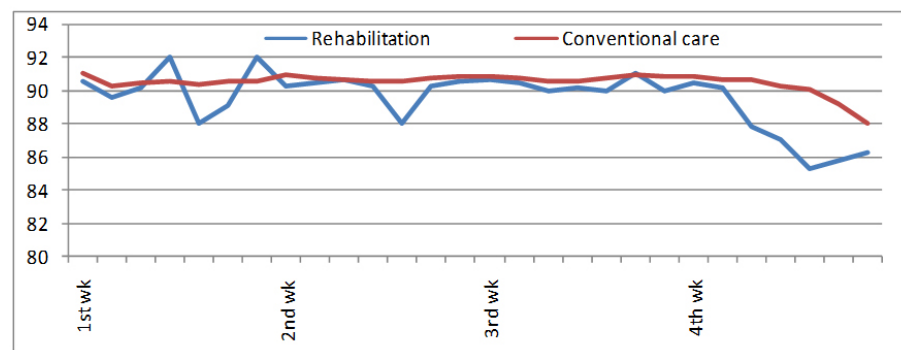


Figure 2. Mean pulse among the study and control group

Concerning the mean respiration among both group, illustrated that there was no significant difference between the two groups at the beginning of the program. Whereas there

was a statistical significant difference between two groups at the end of the program ($p = .003$) (see Figure 3).

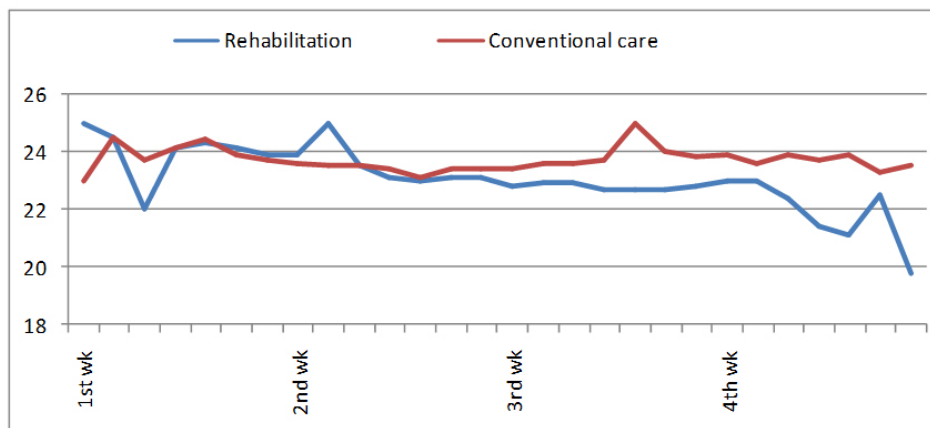


Figure 3. Mean respiration among the study and control group

Regarding the mean differences of systolic and diastolic blood pressure among study (rehabilitation) and control (conventional care) groups through the study period it was observed that, there was no statistical significant difference between the studied groups (see Figure 4). In relation to mean

BGL within the studied groups, it is observed, there was no statistical significant difference between the two groups at the beginning of the study ($p = .467$), on the other side mean difference between both groups at the end of the study was significant ($p = .29$) (see Figure 5).

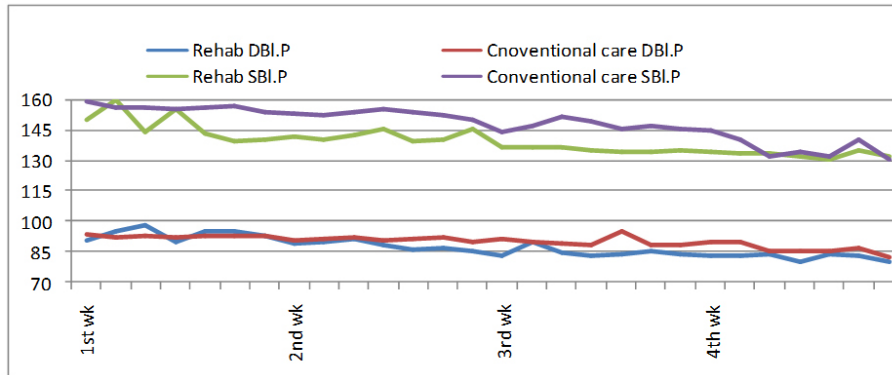


Figure 4. Mean systolic and diastolic pressure among study and control group

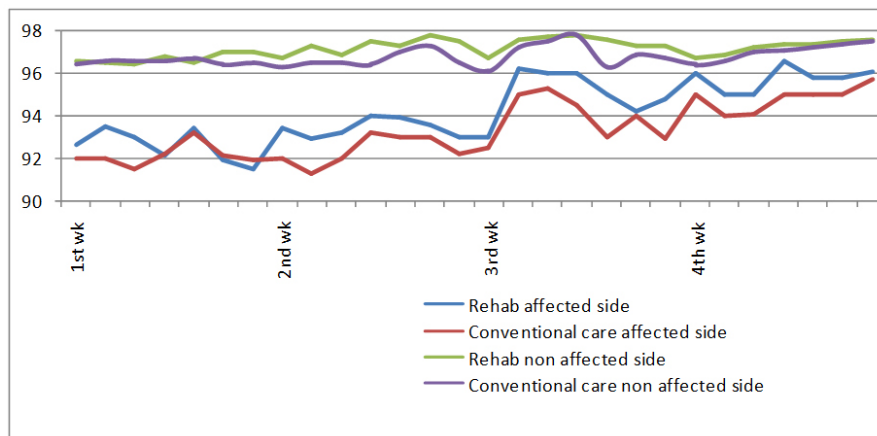


Figure 5. Mean blood glucose level among the studied groups

In relation to mean O₂ saturation which was illustrated that there was a constant increase in O₂ saturation measured from non affected side, furthermore there was an improvement in mean O₂ saturation in the affected side through the study period in both groups but with no statistical significant differ-

ence. Although the mean O₂ saturation increased from the begin to the end of the study among patients of both groups, study group show high levels of O₂ saturation than control group (see Figure 6).

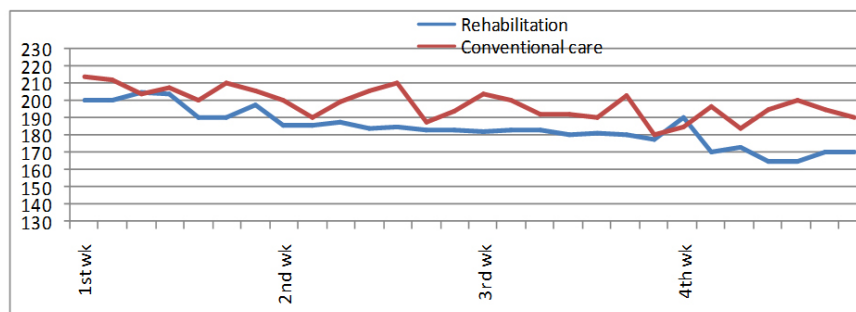


Figure 6. Mean O₂ saturation level between study and control group

Figure 7 reflects a comparison between the study and control groups regards the differences of NIHSS score through the study period. Regarding to neurological improvement

among studied groups after one month, it can be observed from Figure 7 that there was a high statistical significance between studied groups ($p = .000$).

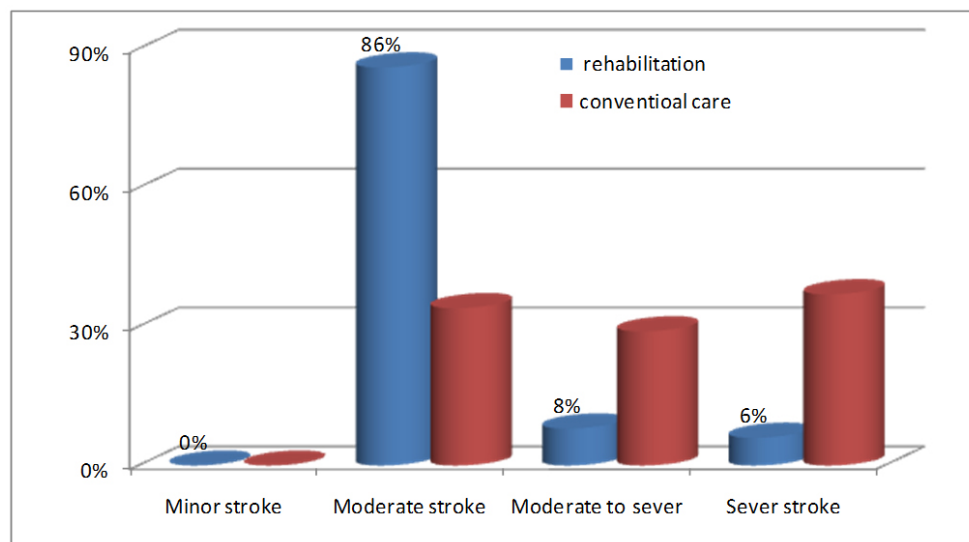


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4. DISCUSSION

The post-stroke patient suffering many physical, neurological and physiological complications.^[30] Post-stroke rehabilitation aiding in reducing any deficits resulting from a stroke, or its complications.^[29] Roles of stroke rehabilitation nurses should be organized around several priorities aimed at ensuring optimal physical recovery, facilitate independence, reduce complications, and adapt to disability.^[30] Therefore, the current study concentrated on the rehabilitation care for stroke patients, applied early in the acute stage post stroke. The potential differences between rehabilitation and conventional care groups were examined in terms of neurological recovery and physiological outcome.

It is noticeable from the current study that, the mean age of the study group was 54.8 ± 8.1 years, while the mean age of the control group was 55.3 ± 8.1 years. This is the same line with El-shamaa et al. (2011)^[31] Who found that the majority of stroke subjects were among the age group of fifty to sixty years old. Males were more prevailing in the studied sample. This in-line with Ojaghihaghghi (2017)^[32] who stated that 53.1% were male. Patients married were prevailing in the studied groups. More than fifty percent of the studied groups were read & write. Ischemic stroke was the most common diagnosis among study and control groups (90.6% and 84.4% in that order). More than one half (59.4%) of the study group and (68.7%) of the control group present with left-sided hemiplegia.

The current study revealed that ischemic stroke is the most commonly founded diagnosis. These findings are in agreement with the findings of Ojaghihaghghi (2017)^[32] who stated that 144 patients (28.6%) were diagnosed with a hemorrhagic stroke and 359 patients (71.4%) were diagnosed with ischemic stroke.

The current study found that the mean body temperature measurements decrease constantly and go within normal range through the study period for study (rehabilitation) group, while there is fluctuation and deviation from normal for the first 3rd and 4th weeks for the control group this maybe due to immobility.^[33] Whereas there is no significant difference between studied groups. These findings are concurrent with Nabih (2014)^[34] who documented that the mean body temperature deviates from normal at six weeks after stroke in late rehabilitation group this may be attributed to the presence of infection. Also, these findings are in the same line with Whiteley et al. (2009)^[35] who documented that the normal temperature rhythm is disturbed after stroke due to impaired physical activity.

In the current study pulse and blood pressure measurements showed stability within normal value through the study period without any statistically significant difference between the studied groups. This can be referred to as a post-physical training vasodilatation that reduces peripheral resistance.^[36] These results come in the same line with Chen CK et al. (2018)^[37] who recommended that cardiovascular fitness ap-

pear to enhance after early stroke rehabilitation, and enhanced cardiovascular fitness may be connected with pulse and blood pressure improvement. Also, these findings go well together with Kluding et al. (2011)^[38] and Billinger et al. (2012)^[39] which confirming the therapeutic role of physical activity in helping the control of blood pressure and heart rate.

Moreover, the results of the current study revealed that there was a statistically significant difference ($p = .001$) between studied groups regarding respiratory rate. This difference may be due to the positive impact of early mobilization, exercise, and chest physiotherapy. These findings are in the same direction study by Seo et al. (2017)^[40] who reported the respiratory exercise has positive impacts on stroke patients' respiratory muscles during the diaphragm breathing exercise. Also similar to Song and Park (2015)^[41] reported that chest resistance and expansion exercises were helpful for improving pulmonary function in stroke patients.

In relation to blood glucose level, the current study shows that hyperglycemia most commonly appeared in the control group with statistically significant difference ($p = .029$). These findings are congruent with Vina et al. (2012)^[42] which clarifies that regular exercise can improve glucose homeostasis and insulin sensitivity by inducing adaptations in the body composition and metabolism.

Regarding O₂ saturation, the results of this study illustrated that both study and control groups show improvement in O₂ saturation from the affected and nonaffected side without any significant difference. This improvement may be attributed to oxygen supplementation that provided to the patient in addition to exercise and chest physiotherapy.^[43] These findings are congruence with Singhal (2007)^[44] who reported that oxygen supplementation is improving stroke outcome and neuroprotection. These findings also in the same direction with Nabih (2014)^[34] who reported that both early and late rehabilitation groups exhibit improvement in O₂ saturation.

The findings of the current study demonstrate that, there is a

neurological recovery in the study group compared with the control group. This is in accordance with the study by Nabih (2014)^[34] who reported that neurological improvement revealed by NIH stroke scale which increased significantly in the early rehabilitation group compared with late rehabilitation group and continue to improve through the study period. Also, Teasell (2018)^[45] stated that, neurological recovery of impairment and functional recovery of independence are influenced by compensatory learning methods as rehabilitation and alternative factors as family support. In contrary to the results of the current study Umphred et al. (2013)^[46] who expressed caution about training in the early post-stroke period, speculating that abnormal cardiovascular responses to exercise may impede perfusion of ischemic brain tissue during the period when cerebral auto-regulation is most often impaired.

5. CONCLUSION

Stroke rehabilitation within multidisciplinary teamwork which focuses on key physiological variables delivers better post-discharge outcomes for stroke patients and limit neurological damage by controlling abnormal physiological parameters. The current study shows strong evidence that acute stage stroke rehabilitation enhances and aids stabilization of physiological parameters, and subsequently neurological state.

Recommendation

- Strongly recommend that starting a rehabilitation program once the patient is medically stable based on a comprehensive assessment, to assess the patient's rehabilitation needs.
- Planning to continue outpatient rehabilitation services which follow-up by a primary care provider.

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CONFLICTS OF INTEREST DISCLOSURE

The author announces that they have no conflict of interests.

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