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Effect of Implementing Fever, Hyperglycemia & Dysphagia Management Protocol on Selected Outcomes among Acute Ischemic Stroke Patients

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ABSTRACT

Background: Literatures had cited that, Fever, hyperglycemia, and dysphagia are common yet often underestimated complications that can significantly impact stroke outcomes. As healthcare systems seek to optimize care, there is growing interest in standardized protocols addressing these complications.

Purpose: is to evaluate the effect of implementing a designed nurse-initiated fever, hyperglycemia & dysphagia management protocol on selected outcomes among acute ischemic stroke patients.

Methods: A quasi-expremental study was conducted in a stroke unit affiliated to private health care sector, involving 70 male & female adult patients with acute ischemic stroke at a stroke (35 matched subjects in each study and control groups). Four tools were used to collect data pertinent to this study. The study group received the designed protocol of care in adition to the routine hospital care. Follow-up assessments evaluated patient outcomes including length of stay, frequency of complications, functional dependency, and disability after stroke.The study hypothesized that the implementation of the protocol would result in improving outcomes for the study group patients as compared to the control group ones.

Results: The majority of both groups were females, married and their age was more than 60 years old in percentages of 71.4%, 74.2% & 54.3% respectively. The most prominent cormbidites in both groups were Hypertension, Diabetes Mellitus and history of smoking in percentages of 76%, 39% and 39% respectively. The study group showed a significant improvements in temperature and blood glucose levels control with the following t and p values ($t = 2.6$, $p = 0.01$) & ($t = 2.05$, $p = 0.04$) respectively which can support the 1st two hypotheses. The 4th and 5th hypotheses also can be supported as the study group showed a shorter length of stay and improved functional dependency scores with the following t and p values ($t = 2.07$, $p = 0.04$) and ($t = -2.16$, $p = 0.03$) respectively. Moreover, the frequcency of complications were lower in the study group in the frequency of aspiration pneumonia and pressure ulcers with the following χ^2 and p values ($\chi^2 = 4.242$, $p = 0.039$) and ($\chi^2 = 3.968$, $p = 0.04$) respectively, which also can support the 7th hypothesis. However, the second hypothesis regarding malnutrition and dehydration can not be supported, as there were no significant differences in discharge BMI and cumulative balance with the following χ^2 and p values ($\chi^2 = 7.06$, $p = 0.07$) and ($\chi^2 = 0.324$, $p = 0.56$) respectively . Similarly, the 6th hypothesis related to disability degree can not be supported as there were no significant differences in modified Rankin scores between both groups ($\chi^2 = 7.06$, $p = 0.07$).

Conclusion: Implementing fever, hyperglycemia and dysphagia protocol can reduce the frequency of complications among acute ischemic stroke patients and enhance their clinical outcomes.

Recommendations: Monitoring & controlling of fever, hyperglycemia and dysphagia among acute ischemic stroke patients need to be highly considered within the routine management frameworks of such patients. Morever, further research studies have to be conducted on a larger probability sample and different geographical locations.
Keywords: Acute ischemic stroke, Fever, Hyperglycemia, Dysphagia, patient outcomes.

1. INTRODUCTION

Acute stroke is a significant global health concern due to its high prevalence, substantial morbidity, and mortality rates. It is a leading cause of long-term disability and poses a substantial burden on healthcare systems (Feigin et al., 2021). In Egypt, stroke is considered the 3rd leading cause of death following ischemic heart diseases and cirrhosis (Vos et al., 2020).

Complications following a stroke are frequently observed after an acute event and significantly affect clinical outcomes, prolong recovery, and increase rates of morbidity and mortality. These complications are classified as medical or neurological issues that require a physician's intervention and ongoing monitoring by healthcare staff. The occurrence of one or more medical complications in patients after an acute stroke varies widely, ranging from 44% to 95%. The primary independent risk factors associated with negative post-stroke complications include advanced age and the severity of the stroke. (Gunawardhana,2021).

Fever, hyperglycemia, and dysphagia are common complications that correlate with poor prognoses in stroke patients. Approximately 50% of stroke patients exhibit temperatures surpassing 37.5°C, while an equivalent percentage experiences hyperglycemia. Moreover, up to three-quarters of individuals recovering from strokes encounter dysphagia, rendering them three times more prone to developing pneumonia compared to counterparts devoid of swallowing complications (Kenny, Barr & Laver 2016).

Elevated body temperature is frequently observed in individuals with acute ischemic strokes. When fever occurs within the initial 24 hours after stroke, it is linked to a twofold increase in the mortality rate. Additionally, Study studies involving ischemic strokes have shown that higher body temperatures are connected to larger infarct areas and less favorable functional outcomes (Mergenthaler, Dirnagl & Kunz, 2022).

Hyperglycemia is a frequent occurrence among patients hospitalized for acute ischemic stroke. It can stem from diabetes mellitus, particularly type 2 diabetes, due to prolonged high blood sugar levels from insulin deficiency. However, hyperglycemia isn't exclusive to diabetic patients; it's also common in non-diabetic individuals due to the body's stress responses triggered by extensive brain injury (Ferrari, Moretti & Villa, 2022).

Dysphagia manifests in more than 50% of individuals experiencing acute stroke, emerging as a significant predisposing factor for aspiration pneumonia in this patient population. The reported incidence of aspiration pneumonia among stroke patients with dysphagia ranges from 20% to 47%. The onset of pneumonia in stroke patients contributes to protracted hospital stays, suboptimal clinical prognoses, and a threefold escalation in 30-day mortality rates (Yang, Choo & Chang, 2021).

To address these complications, Middleton et al. (2011) undertook the "Quality in Acute Stroke Care" (QASC) trial in Australia to investigate whether a nurse-led intervention tailored to address fever, hyperglycemia, and dysphagia subsequent to a stroke could ameliorate patient outcomes. The study outcomes revealed a noteworthy decrease in mortality rates and dependency on care at the 90-day mark among patients in the intervention group in comparison to those in the control group (Kenny, Barr & Laver 2016).

The Fever, Hyperglycemia, and Dysphagia Management Protocol includes temperature readings to be diligently tracked during the initial 72 hours, with prompt treatment if ≥37.5°C. Blood glucose assessment occurs upon admission, followed by continuous monitoring with insulin administration if glucose levels exceed >10 mmol/L (>180 mg/dL). Dysphagia screening is conducted within the initial 24 hours of admission, with subsequent referral to a speech and language therapist upon identification (Middleton et al., 2023).

The implementation of the Fever, Hyperglycemia and dysphagia management protocol yielded favorable results irrespective of the economic status of the country. An exploratory assessment conducted across 64 hospitals in 17 diverse countries revealed that adherence to the Fever, Hyperglycemia & Dysphagia management protocol demonstrated comparable levels of improvement in both high-income and middle-income nations (Middleton et al., 2023).

Regarding the efficacy of implementing the Fever, Hyperglycemia and Dysphagia Management protocol, patients receiving the nurse-initiated Fever, Hyperglycemia & Dysphagia management protocol experienced a substantial 16% absolute decrease in death and dependency within 90 days following a stroke. Furthermore, this intervention sustained a notable 20% relative enhancement in survival over a span of 4 years' post-stroke (Middleton, et al. 2023).

Therefore, the aim of this study is to evaluate the effect of implementing Fever, hyperglycemia & dysphagia as a nurse-initiated management protocol on selected outcomes among acute stroke patients. To fulfill the aim of this study the following research hypotheses were formulated:

H1: The Mean temperature degrees for the study group subjects who received Fever, hyperglycemia and dysphagia management protocol would be lower than that among the control group subjects.

H2: The Mean blood sugar levels for the study group subjects who received Fever, hyperglycemia and dysphagia management protocol would be lower than that among the control group subjects.

H3: The frequency of malnutrition and dehydration for the study group subjects who received Fever, hyperglycemia and dysphagia management protocol would be lower than those among the control group subjects.

H4: The Average length of hospital stay for the study group subjects who received Fever, hyperglycemia and dysphagia management protocol would be lower than that among the control group subjects.

H5: The mean scores of the functional dependency for the study group subjects who received Fever, hyperglycemia and dysphagia management protocol will be higher than those among the control group subjects.

H6: The mean scores of the degree of disability for the study group who received Fever, hyperglycemia and dysphagia management protocol will be lower than those among the control group subjects.

H7: The Frequency of complications for the study group subjects who received Fever, hyperglycemia and dysphagia management protocol would be lower than those among the control group subjects.

Operational Definitions:

Selected patient outcomes includes several key metrics that were assessed in acute ischemic stroke patients included in the study including:

- Average length of hospital stay.
- Functional dependency levels using Barthel index score.
- Degree of disability on discharge using modified Rankin Scale.
- Frequency of post stroke complications.

Description of the Fever, hyperglycemia and dysphagia protocol: It is a set of different practical interventions directed towards monitoring and early management of fever, hyperglycemia and dysphagia to minimize the frequency of possible complications and enhance the patient outcomes. This protocol includes three main domains; fever management, hyperglycemia control, and dysphagia management. Regarding fever management it includes close temperature monitoring and early managing the raised temperature more than 37.5°C. For blood sugar control, close blood glucose levels monitoring with a tailored monitoring regimn for diabetics and non-diabetics and early management of increased blood glucose levels more than 10 mmol/L (180 mg/dL). In regards dysphagia management, the protocol encompasses dysphagia screening using Gugging Swallowing Screen (GUSS) test on admission and prior to oral intake and patients failing the swallowing screen are referred to a speech pathologist or neurology specialist for comprehensive assessment. Moreover, daily swallow strengthening exercises were done and following up the hydration status of the patients through monitoring of fluid intake and output and monitoring their nutritional screening through monitoring of their body mass index.

2. METHODS

2.1 Research design

A quasi expremental study research design was utilized in this research.

2.2 Setting and samples : The study was carried out at a stroke unit affiliated to a private healthcare sector in Egypt, The hospital has 300+ beds and it contains more than 100 ICU beds equipped with all critical care equipment. The stroke unit contains 6 beds, all beds are equipped with advanced monitoring equipment, including continuous cardiac monitoring, blood pressure monitoring, and EEG monitoring to closely monitor the patient's condition.The hospital has a CT and MRI facility that served the unit, and

it followed the acute stroke pathway based on ASA and AHA guidelines.

A Purposive sample of 70 adult male & female patients had been recruited to the study, half of them constituted the control group & the other half matched patients constituted the study group. Inclusion criteria includes : Age 18 years old or older, acute stroke patient admitted to stroke unit within 24 hours from the onset and GCS > 11 .While Exclusion criteria includes: Patient's unwillingness to continue cooperation, onset of stroke after 24 hrs, mechanically ventilated patients and patients with GCS < 11. The Study and the control groups had been matched according to age group, gender admission BMI, GCS, smoking habits, diagnosis, comorbid diseases, admission body temperature, admission blood glucose level and admission Gugging Swallowing Screen (GUSS) severity score.

2.3 Intervention:

The research was conducted in two phases: preparatory and implementation phases.

1. Preparatory phase: Involved preparation of the intervention protocol of care, study tools and permissions to conduct the study.
2. Implementation phase: Once the needed permissions were obtained to proceed, the researcher approached the stroke unit head nurse to explain for her the study and get her cooperation and to get the list of stroke patients in the unit who are fitting the inclusion criteria of the study, also she was requested to notify the researcher with all the new stroke patients. The researcher had explained the purpose and the nature of the study to the nurses inside the unit. Frequency of admissions who were eligible and fitting the inclusion criteria were about one to two cases per week.

The researcher started with the control group. Upon admission, the eligible patients or their relatives were interviewed individually for 20 min each, during morning/ afternoon shift by the researcher to explain the nature and the aim of the study to establish rapport and to gain their cooperation. Then written consents were obtained from patients/ relatives. The control group were exposed to the routine hospital care only. The researcher was visiting the patient daily on the morning and afternoon shifts. Once the patient was enrolled, the researcher assessed patients' conditions, collected sociodemographic data, and medical history using Tool 1 (Demographic Characteristics and Medical Data Sheet). Daily monitoring of temperature, blood sugar, and dysphagia symptoms were obtained until discharge according to the routine care. Upon discharge, disability levels and ability to perform daily activities were evaluated using Tool 3 (Modified Rankin Scale) and Tool 4 (Barthel Index).

After completion of the control group, the researcher started to enroll the study group subjects following the predetermined matching criteria. Then the researcher started to apply the same practices for explaining the purpose and nature of the study through individual interview and obtain the informed consent to participate in the study. The study group were exposed to the routine hospital care in addition to the application of the fever, hyperglycemia & dysphagia Management protocol on daily basis during morning and afternoon shifts applying the component of the protocol. Upon admission, the researcher assessed patients' conditions, collected sociodemographic data, and medical history using Tool 1. Additionally, Tool 2 (Gugging Swallowing Screen) was used to evaluate swallowing ability. The researcher conducted daily 30-minute swallowing strengthening exercises for each patient and monitor the patient nutrition and hydration status. Temperature was closely monitored and early management protocol of raised temperature more than 37.5° C was initiated including removal of extra blankets, cold compresses, administration of paracetamol as doctor order and considering the start of septic workup as cultures and other diagnostic evaluations as presecribed. For blood Glucose monitoring; a schedule for monitoring based on the patients' diabetic status was setteled and management protocol for blood glucose level more than 10 mmol/L (180 mg/dL) was established. Upon discharge, disability levels and ability to perform daily activities were evaluated using Tool 3 (Modified Rankin Scale) and Tool 4 (Barthel Index). Researcher consumed nearly two to four hours per day for each patient all through study period. Nursing and medical staff were cooperative. Patient' medical and nursing records were utilized in data collection. Implementation of this study was fulfilled over a period of one year.

2.4 Measurement and data collection

The study utilized four assessment tools to evaluate various aspects of stroke patients' conditions and outcomes:

1. Demographic Characteristics and Medical Data Sheet: This comprehensive tool collected patient information including patient demographics, heamodynamic variables, hydration and fluid balance data, body system related data and complications during the hospital stay.

2. Gugging Swallowing Screen (GUSS): Developed by Tape et al. in 2006, this tool assesses swallowing abilities and aspiration risk. It consists of two parts: a preliminary investigation/indirect swallowing test and a direct swallowing test using various food textures. The GUSS scoring system categorizes dysphagia severity into four levels based on scores: severe (0-9 points), moderate (10-14 points), mild (15-19 points), and no dysphagia (20 points). Each category is associated with specific dietary and care recommendations. The Gugging Swallowing Screen (GUSS) showed excellent performance with 93.3% sensitivity and 83.3% specificity at a cutoff of 14 points, along with high inter-rater reliability. Its effectiveness was further supported by systematic reviews and additional studies, establishing it as a recommended tool for nurses in clinical settings

3. Modified Rankin Scale (mRS): This scale evaluates post-stroke disability. Originally introduced by Dr. John Rankin in 1957 and later modified by Charles Warlow and colleagues, the mRS has become a primary outcome measure in acute stroke trials. It assesses the degree of disability or dependence in daily activities, ranging from Scoring system of this tool (0: No symptoms, 1: No significant disability, 2: Slight disability, 3: Moderate disability, 4: Moderately severe disability, 5: Severe disability, 6: Dead). The modified Rankin Scale (mRS) demonstrated good reliability across multiple studies, with a pooled weighted kappa of 0.90 in a meta-analysis.

4. Barthel Index: This tool measures improvement in clients with chronic disability undergoing rehabilitation. It assesses the patient's ability to perform activities of daily living (ADL), including feeding, bathing, grooming, dressing, bowel and bladder control, toilet use, transfers, mobility, and stair use. Scores range from 0 (completely dependent) to 100 (independent in all assessed ADLs), providing a quantitative measure of a patient's functional independence. The Barthel Index exhibited excellent inter-rater reliability for standard administration after stroke, with a weighted kappa of 0.93 (95% CI: 0.90-0.96).

2.5 Data analysis

Data obtained from the study tools were categorized, tabulated, analyzed and data entry was performed using the SPSS software (statistical package for social sciences version 21.0). Descriptive statistics were applied (e.g. mean, standard deviation, frequency and percentage). Test of significance was performed to test the study hypothesis (i.e. independent t- test and chi square test). Pearson's correlation coefficient and regression analysis were applied between quantitative variables. Probability (p- value) less than 0.05 was considered significant and less than 0.001 considered as highly significant.

2.6 Ethical considerations

An official permission to conduct the proposed study was obtained from the ethical committee and hospital directors. Participation in this study was voluntary; each potential subject was informed about the purpose, procedure, benefits, and nature of the study and that he/she had the right to withdraw from the study at any time without any rationale, then written consent obtained from them. Subjects were informed that obtained data will not be included in any further researches without second consent. Confidentiality and anonymity of each subject were assured through coding of all data and all information has taken was protected and didn't affect their annual appraisal.

3. RESULTS

3.1 Finding related to background and medical data:

Table 1 demonstrates demographic homogeneity between the control and Study groups, with no statistically significant differences observed in sex, age group, marital status, or smoking status (all p-values > 0.05). This baseline equivalence strengthens the validity of subsequent comparisons between the groups. The sample was predominantly females (71.4%), with a majority of participants (54.3%) aged over 60 years in both control and Study groups. Married individuals constituted the largest proportion of the sample (74.2%). Regarding smoking status, 39% of participants were current smokers, while 49% were non-smokers, and 13% were former smokers.

Table 1: Percentage Distribution of Patients' Data Related to patient characteristics in both Control & Study Groups (n=70):

Groups/ X^2 & p-value	**Total** , N = 70	**Groups**		**X^2 / p-value**
		Control, N = 35	**Study**, N = 35	

Variables		No	%	No	%	No	%	X^2	p-value
Gender	Male	20	28.6%	10	28.6%	10	28.6%	0.00	1.0
	Female	50	71.4%	25	71.4%	25	71.4%		
Age Group	20-40	6	8.6%	3	8.6%	3	8.6%	0.00	1.0
	41-60	26	37.1%	13	37.1%	13	37.1%		
	>60	38	54.3%	19	54.3%	19	54.3%		
Marital Status	Single	1	1.4%	0	0%	1	2.9%	1.92	0.58
	Married	52	74.2%	28	80%	24	68.6%		
	Divorced	3	4.2%	1	2.9%	2	5.7%		
	Widowed	14	20%	6	17.1%	8	22.9%		
Smoking Status	Smoker	27	39%	12	34%	15	43%	0.9	0.6
	Non-smoker	34	49%	19	54%	15	43%		
	Quit smoking	9	13%	4	11%	5	14%		

Table 2 presents the distribution of comorbidities among the study participants, with no statistically significant differences observed between the control and Study groups (all p-values > 0.05). This comparability in pre-existing conditions strengthens the internal validity of the study. Hypertension was the most prevalent comorbidity, affecting 76% of the total sample. Diabetes mellitus was present in 39% of participants. Cardiac problems were noted in 33% of the sample. Other comorbidities, including chest, liver, oncological, and kidney problems, were less common, each affecting 6% or fewer of the participants.

Groups/ X^2 & p-value / Variables		**Total** , N = 70		**Groups**				X^2 / p-value	
				Control, N = 35		**Study**, N = 35			
		No	%	No	%	No	%	X^2	p-value
Diabetes	Diabetic	27	39%	11	31%	16	46%	0.15	0.22
	Non -diabetic	43	61%	24	69%	19	54%		
HTN	Yes	53	76%	27	77%	26	74%	0.078	0.78
	No	17	24%	8	23%	9	26%		
Cardiac Problems	Yes	23	33%	13	37%	10	29%	0.58	0.44
	No	47	67%	22	63%	25	71%		
Chest Problems	Yes	4	6%	2	6%	2	6%	0	1
	No	66	94%	33	94%	33	94%		
Liver Problems	Yes	3	4%	2	6%	1	3%	0.34	0.55
	No	67	96%	33	94%	34	97%		
Oncology Problems	Yes	1	1%	0	0%	1	3%	1.01	0.31
	No	69	99%	35	100%	34	97%		
Kidney Problems	Yes	3	4%	1	3%	2	6%	0.34	0.55
	No	67	96%	34	97%	33	94%		

Table 2: Percentage Distribution of Patients' Data Related to the Comorbidities in both Control & Study Groups (n=70)

Figure 1 details the time from stroke onset to hospital arrival, with no statistically significant differences observed between the control and Study groups ($\chi^2 = 0.47$, $p = 0.79$). The data indicate that 21% of the total sample arrived at the hospital within the first 4.5 hours of stroke onset. Moreover, the majority of patients arrived to the hospital arrived to the hospital after 6 hours from the onset.

Figure 1: Comparison Between both Control & Study Groups in Regards to the Onset of stroke (n=70):

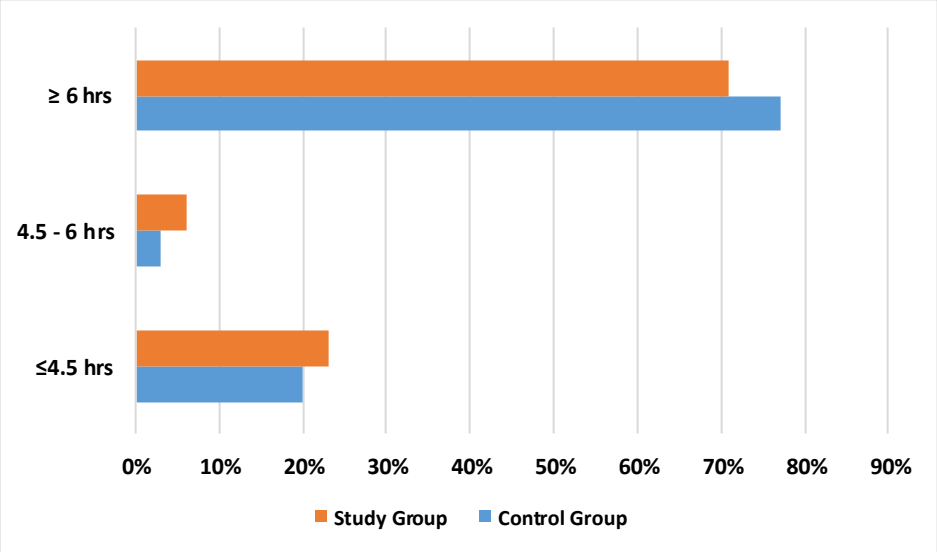


Table 3 delineates the distribution of key stroke-related signs and symptoms on admission, with no statistically significant differences observed between the control and Study groups (all p-values > 0.05). Speech problems were prevalent, affecting 50% of the total sample, with dysarthria (36%) being more common than aphasia (14%). Limb weakness was a predominant feature, present in 89% of participants, with a slightly higher incidence of left-side weakness (49%) compared to right-side weakness (40%). Facial drop was less frequent, occurring in 17% of cases, with left-side involvement (13%) being more common than right-side (4%).

Table 3: Comparison Between both Control & Study Groups in Regards to Signs & Symptoms on Admission: (n=70):

Variables / Groups/ X^2 & p-value		**Total** , N = 70		**Groups**				**X^2 / p-value**	
				Control, N = 35		**Study**, N = 35		**X^2**	**p-value**
		No	%	No	%	No	%		
Speech problems	Aphasia	10	14%	5	14%	5	14%	3.36	0.18
	Dysarthria	25	36%	9	36%	9	36%		
	No Problem	35	50%	21	50%	21	50%		
Limb weakness	Rt. side	28	40%	16	40%	16	40%	2.57	0.27
	Lt. Side	34	49%	17	49%	17	49%		
	No Limb weakness	8	11%	2	11%	2	11%		
Facial drop	Rt. side	3	4%	2	4%	2	4%	0.51	0.77
	Lt. Side	9	13%	5	13%	5	13%		
	No facial drop	58	83%	28	83%	28	83%		

3.2. Finding related to testing the research hypothesis:
H-1 and H-2 State that:
The Mean temperature and the total mean random blood sugar for the study group those received Fever, hyperglycemia and dysphagia management protocol of care would be lower than those in control group. (Table 4 is related to those hypotheses)

Table (4) illustrates that the total mean temperature for the control group was 37.09 ± 0.25°C while it was 36.9 ±0.17°C for the study group with high statistically significant difference between both groups (t= 2.6 & p= 0.01). Moreover, the total mean random blood sugar for the control group was 165.4± 41.2 mg/dl while it was 145.8 ± 38.04 mg/dl for the study group with statistically significant difference between both groups (t= 2.05 & p= 0.04). Therefore, the first and second hypotheses can be supported.

Table 4: Comparison between total mean temperature and total mean ranodom blood sugar control & Study groups (n=70):

Variable	**Control,** N = 35	**Study ,** N = 35	**t test**	**P Value**
Total mean temp.	37.09 ± 0.25	36.9 ±0.17	2.6	0.01*
Total mean RBS	165.4± 41.2	145.8 ± 38.04	2.05	0.04*
** Highly Significant at p ≤0.01	*significant at p-value<0.05			

H-3 Stated that:
The frequency of malnutrition and dehydration for the study group those received Fever, hyperglycemia and dysphagia management protocol of care would be lower than those in control group. (Table 5, 6 and 7 are related to this hypothesis)

Table (5) illustrates that around half of the studied sample (46%) in both groups had complained from obesity on discharge with no statistically significant differences between both control and study groups ($\chi 2$= 1.42 & p= 0.49).

Table 5: Comparison Between Control & Study Group Regarding Discharge BMI (n=70):

BMI	**Control**, N = 35		**Study**, N = 35		**X^2 / p-value**	
	No	%	No	%	$\chi 2$	*P* Value
Normal	7	20%	4	11%	1.42	0.491
Overweight	12	34%	16	46%		
Obese	16	46%	15	43%		

Table 6 compares the timing of feeding initiation between the control and study groups for stroke patients. It revealed a statistically significant difference in the distribution of feeding start dates between both groups ($\chi 2$ = 13.9, p = 0.003). The study group demonstrated a notably higher proportion of patients starting feeding on the first day (91%) compared to the control group (57%). Conversely, the control group had more patients starting feeding on the second (34%) and third (9%) days compared to the study group (6% and 0% respectively). Interestingly, one patient (3%) in the study group was kept NPO (nil per os), while no patients in the control group were in this category.

Table 6: Comparison Between Control and Study Groups in Regards to Date of Starting Feeding (n=70):

Start Feeding Date	**Control**, N = 35		**Study**, N = 35		**X^2 / p-value**	
	No	%	No	%	$\chi 2$	*P* Value
1st Day	20	57%	32	91%	13.9	0 .003*
2nd Day	12	34%	2	6%		

3rd Day	3	9%	0	0%		
Keep the Patient NPO	0	0%	1	3%		

Table 7 demonstrates a comparison between the control and study groups in regards to the cumulative balance, which highlights that the positive balance samples were higher in the study group than those in the control group, however with no statistically significant difference between both groups ($\chi 2$= 0.324 & p= 0.56). Based on finding of (table 5,6 and 7) hypothesis three can not be supported.

Table 7: Comparison Between Control & Study Group Regarding the Cumulative Balance (n=70):

Fluid Balance	**Control, N = 35**		**Study, N = 35**		**X^2 / p-value**	
	No	**%**	**No**	**%**	**$\chi 2$**	**P Value**
Positive Balance	26	74%	28	80%	0.324	0.56
Negative Balance	9	26%	7	20%		

H-4 Stated that:
The Average length of stay for the study group those received Fever, hyperglycemia and dysphagia management protocol of care would be lower than those in control group.

(Table 8 is related to this hypothesis)
Table 8 reveals that the mean length of stay in control group is 5.4± 4.7 days, while the mean length of stay on the study group was 3.7 ±1.01 days with statistically significant difference between both groups (t= 2.07 & p= 0.04). Based on this finding ,hypothesis four can be supported.

H-5 stated that:
The mean scores of the functional dependency for the study group who received treatment of Fever, hyperglycemia and dysphagia management protocol will be higher than those in the control group. (Table 8 is related to this hypothesis)
Table 8 illustrates a comparison between the mean total scores for both groups in regards to the discharge scores of Barthel index & it shows that the mean score for the control group was 65.5 ± 28.8 compared with 75.7 ± 15.7 for the study group with a statistically significant difference between both groups (t value= -2.16 & P= 0.034). Based on finding of (table 11) hypothesis five can be supported.

Table 8: Comparison Between both Control & Study Groups in Regards to the Length of Hospital Stay and Brathel index on discharge (n=70):

Variable	**Control**, N = 35[1]	**Study**, N = 35[1]	**t test**	**P Value**
Length of Stay Mean ± SD	5.4± 4.7	3.7 ±1.01	2.07	0.04
Barthel Index Mean ± SD	65.5 ± 28.8	75.7 ± 15.7	-2.16	0.034

H6 stated that:
The mean scores of the degree of disability for the study group who received treatment of Fever, hyperglycemia and dysphagia management protocol will be lower than those in the control group. (Figure 2 is related to this hypothesis)
Figure 2 compares the Modified Rankin Score (MRS) between control and study groups on discharge which indicates that, the distribution of disability levels in the control group was higher proportion in slight disability (40%), followed by the category of moderate disability (37%). On the other hand, in the study group, it shows the highest category in the slight disability (54%) followed by moderately severe disability category (26%). However, the statistical analysis shows no significant differences in the Modified Rankin Scores between both groups on admission ($\chi 2$=7.06 & p=0.07). Thus, hypothesis six can't be supported.

Figure 2: Comparison Between both Control & Study Groups in Regards to Modified Rankin Score on Discharge: (n=70):

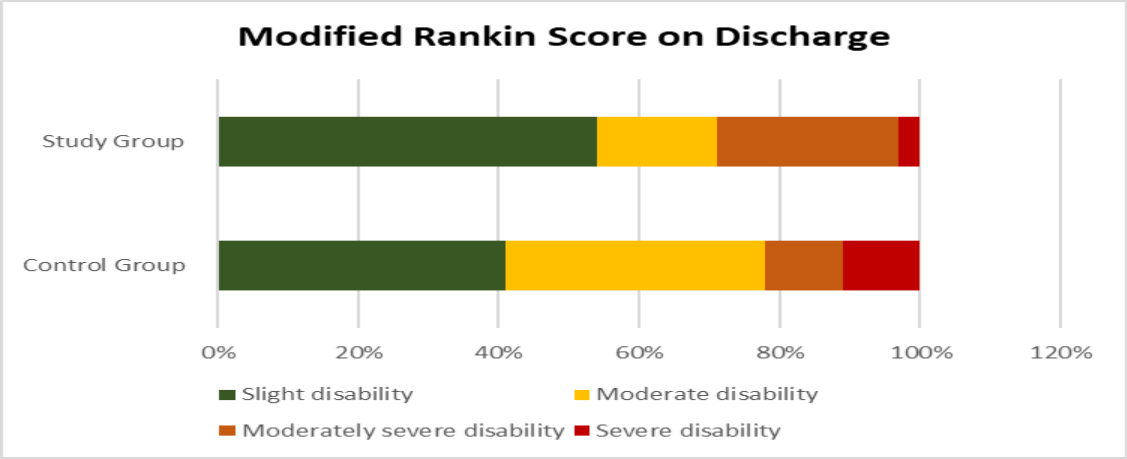
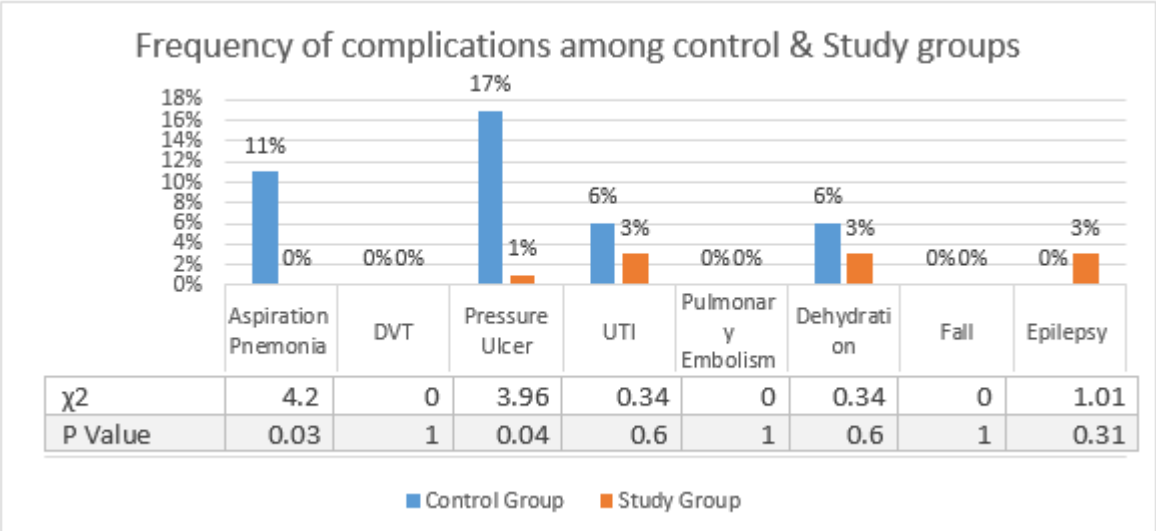


Figure 3 presents a comparison of the frequency of complications development between the control group and the study group in stroke patients. The table examines various potential complications including aspiration pneumonia, deep vein thrombosis (DVT), pressure ulcers, urinary tract infections (UTI), pulmonary embolism, dehydration, falls, and epilepsy. The results reveal statistically significant differences in two complications: aspiration pneumonia and pressure ulcers. Aspiration pneumonia occurred in 11% of the control group but was absent in the study group ($\chi2 = 4.242$, $p = 0.039$). Similarly, pressure ulcers were more prevalent in the control group (17%) compared to the study group (3%), and this difference was also statistically significant ($\chi2 = 3.968$, $p = 0.04$) which can support the 7th hypothesis. For other complications, including UTI, Pulmonary embolism, dehydration, fall and epilepsy, the differences between groups were not statistically significant ($\chi2 = 0.34$, $p = 0.6$, $\chi2 = 0.00$, $p = 1.0$, $\chi2 = 0.34$, $p = 0.6$, $\chi2 = 0.00$, $p = 1.0$ & $\chi2 = 1.014$, $p = 0.34$).

Figure 3: Comparison Between Control and Study Groups in Regards to The frequency of Complications (n=70):



	Aspiration Pnemonia	DVT	Pressure Ulcer	UTI	Pulmonary Embolism	Dehydration	Fall	Epilepsy
χ2	4.2	0	3.96	0.34	0	0.34	0	1.01
P Value	0.03	1	0.04	0.6	1	0.6	1	0.31

4. DISCUSSION

Results of the current study indicated that over half of the sample population was aged 60 years or older. These findings are consistent with the results reported by Shokri et al. (2020), who examined factors related to the time between stroke onset and hospital arrival in Egypt, and found a mean patient age of 63 years. However, Soto-Cámara et al. (2020), in their investigation of age-related

risk factors at the time of first stroke event, reported a higher mean patient age of 75 years. From the researcher's perspective, the differences observed in the mean patient ages across these studies may suggest variations in the demographic characteristics of the respective study populations. This could be influenced by factors such as geographic location, socioeconomic status, and access to healthcare services.

The study results revealed that females constituted more than two-thirds of the sample population. This finding aligns with the research conducted by Branyan & Sohrabji (2020) on gender differences in stroke co-morbidities, which demonstrated that older females exhibit a higher prevalence of ischemic stroke and experience worse outcomes compared to males. These results were consistent with another study of Ruksakulpiwat et al. (2023) who were studying the associations between diagnosis with stroke, comorbidities, and activity of daily living among older adults in the United States, which conveyed that more than half of their studied sample were females. However, these results contrast with those reported by Tork et al. (2020) in their study on outcome predictors of intravenous thrombolytic therapy in acute ischemic stroke patients in Egypt, where around two thirds of their sample comprised male subjects. From a research perspective, the discrepancy in gender distribution across these studies suggests potential variations in study populations, recruitment strategies, cultural contexts or regional differences in stroke epidemiology.

The present study found that approximately three quarters of the sample population were married. This finding is consistent with the research conducted by Kariyawasam, Pathirana, & Hewage, (2020) on factors associated with health-related quality of life in stroke patients in Sri Lanka, which similarly reported that the majority of their study participants were married. However, these results differ from those of Xie , Li & Shi (2024), whose cohort study examining the correlation between marital status and prognosis in older patients with cerebrovascular disease in intensive care units found that only half of their sample were married. From a research standpoint, the marital status is an integral part of social evaluation of stroke patients and underscore the importance of considering marital status as a potential factor influencing stroke outcomes. Being married may reflect enhanced social support, potentially facilitating timely seeking of medical advice. This social dynamic could have significant implications for stroke prevention, early intervention, and overall patient outcomes.

In terms of comorbidities, the present study identified hypertension, diabetes, and smoking as the most prevalent conditions among participants. These findings are consistent with the observations of Webb and Werring (2022), who emphasized that hypertension accounts for more than half of the population-attributable risk for ischemic stroke. They also noted that a 20 mm Hg increase in systolic blood pressure doubles the stroke risk between the ages of 40 and 69. Similarly, Ibrahim, Hassan, and Saber (2021) reported that in their study of the ischemic stroke registry in Egypt, half of the participants had diabetes and one-third were smokers. Conversely, Griñán et al. (2021) found that advanced age (≥ 85 years), female gender, atrial fibrillation, ischemic heart disease, and congestive heart failure were more prevalent in the cardioembolic stroke group, whereas hypertension, diabetes, peripheral vascular disease, heavy smoking, hyperlipidemia, and previous transient ischemic attack were significant risk factors in the atherothrombotic stroke group. From a research standpoint, these findings underscore the multifaceted nature of stroke risk, highlighting the critical role of hypertension, diabetes, and smoking in stroke as modifiable risk factors, while it is important to consider a differentiated risk profile for various stroke subtypes.

With respect to the time interval between stroke onset and arrival to the hospital, the data indicate that a minority of the study population sought medical attention within 4.5 hours. These findings align with Lee et al. (2021), who investigated the impact of onset-to-door time on outcomes and factors associated with delayed hospital arrival in acute ischemic stroke patients. Their research demonstrated that only one third of subjects presented to the hospital within 4.5 hours of stroke onset. However, these results diverge from those reported by Ibrahim, Hassan, and Saber (2021) in their ischemic stroke registry study in Egypt, which found that half of their cohort arrived within 4.5 hours of symptom onset. Nasreldein et al. (2023) further stratified their findings by geographic location, revealing that urban patients presented within the therapeutic time window, compared to those in rural areas in Egypt. From the researcher point of view, the discrepancies in onset-to-door times across these studies highlight the complexity of factors influencing stroke patient behavior and healthcare access including community awareness and cultural differences. These variations underscore the need for targeted public health interventions and improved stroke awareness campaigns, particularly in rural areas, to reduce onset-to-door times and improve patient outcomes.

The current study investigated the signs and symptoms among participants, revealing that the majority experienced limb weakness and speech-related issues. These findings are consistent with the study by Gittins et al. (2021), which highlighted that the majority of stroke patients exhibited motor impairments. Additionally, Jones, O'Connell, and David (2020) found in their systematic review and meta-analysis of functional stroke mimic patients that around half of their sample presented with dysarthria, dysphasia, aphasia, or anomia. Conversely, Jasne et al. (2020), in their study on stroke code presentations and outcomes before and during the COVID-19 pandemic, reported that approximately half of their patients had limb weakness, while only 16% experienced speech difficulties. From the researcher's perspective, motor impairments and speech difficulties represent the most prevalent presentations among stroke patients. This observation is supported by consistent findings across multiple studies which highlight the high frequency of motor and speech-related symptoms in stroke populations. These symptoms are critical indicators of stroke severity and are essential for guiding clinical assessment and intervention strategies.

In the present study, the results demonstrated that the overall mean temperature in the Study group was statistically lower than that of the control group. These findings align with the results reported by Middleton et al. (2011), who found that the mean temperatures for the study group during the first 72 hours in an acute stroke unit after implementing a fever, hyperglycaemia, and swallowing protocol were better than those in the control group. Furthermore, they also reported that, the study group demonstrated better control over recurrent fever attacks. Similarly, Dello et al. (2021) reported a reduction in total febrile events after implementation of fever, hyperglycemia and dysphagia protocol. These findings highlight the improved temperature control achieved through the implementation of the Fever, hyperglycemia and dysphagia management protocol. From the researcher point of view, it is clear that the consistent monitoring and management of temperature, as recommended by the Fever, Hyperglycemia & Dysphagia management protocol, are crucial for controlling the temperature in acute stroke patients and preventing the possible adverse outcomes.

In the current study, blood glucose management revealed that the total mean random blood sugar level in the Study group was significantly lower than that in the control group. These findings align with the research conducted by Kenny, Barr, and Laver (2016), which reported an average blood glucose level of 7.04 mmol following the implementation of the fever, hyperglycemia and dysphagia protocol. Furthermore, Middleton et al. (2023) supported these results by indicating that three quarters of patients with blood glucose levels ≥ 10 mmol/L were managed with insulin within one hour in the post-implementation group of the fever, hyperglycemia and dysphagia protocol, compared to 58% in the pre-implementation group. Similarly, Middleton et al. (2019) found that glycemic control was more effective when implementing fever, hyperglycemia and dysphagia protocol. These findings collectively indicate improved glycemic control associated with the implementation of the fever, hyperglycemia and dysphagia protocol. From the researcher's perspective, the implementation of the Fever, Hyperglycemia, and Swallowing protocol significantly enhances the management of blood glucose levels in acute stroke patients. The findings from the current study indicate that the Study group achieved a lower mean random blood sugar level compared to the control group, demonstrating the effectiveness of structured protocols in glycemic control. The increasing percentage of patients in the Study group maintaining normal blood glucose levels over the first 72 hours highlights the protocol's impact on improving patient outcomes.

The study examined the nutritional and hydration status of stroke patients following the implementation of a Fever, Hyperglycaemia, and Dysphagia management protocol. Results revealed no statistically significant difference in BMI results between the control and study groups at discharge. However, significant differences were observed in feeding initiation timelines .The study group demonstrated earlier feeding initiation, with majority of patients commencing feeding on the first day. This trend extended to fluid balance management, where the study group exhibited higher percentages of positive fluid balance on the first and second days compared to the control group . Interestingly, this pattern reversed on the third day, with the control group showing a slightly higher positive fluid balance. However, there was no statistically significant difference between both groups in the total cumulative balance. These findings suggest that while the implemented protocol may have influenced early feeding practices and daily fluid management, its impact on overall nutritional status and cumulative fluid balance was less pronounced, highlighting the complex nature of nutritional and hydration management in stroke patients.

The data from the current study in the area of early initiation of oral intake supports the research conducted by Brandão et al. (2020), which elucidates that the

implementation of early enteral feeding in patients who have experienced a stroke is correlated with decreased mortality rates and improved functional outcomes. The timely commencement of nutritional support can attenuate the risk of malnutrition, a condition frequently observed among stroke survivors due to dysphagia and other associated complications.

The absence of a statistically significant disparity in Body Mass Index (BMI) at discharge between study groups may be considered a limitation. Holland et al. (2024) observed that while early nutritional interventions led to improved feeding outcomes, they did not necessarily result in substantial alterations in BMI or overall nutritional status in the short term. This finding suggests that although early feeding practices confer benefits, achieving long-term improvements in nutritional status may necessitate extended interventions and follow-up protocols.
Furthermore, a qualitative investigation by Miller et al. (2023) revealed that effective regulation of fluid balance during the acute phase of stroke can prevent dehydration and related complications, which have been linked to less favourable outcomes. The prevalence of dehydration in stroke patients is concerning, with studies indicating that a significant proportion of these patients' experience dehydration during hospitalization, which can lead to poorer outcomes, including increased mortality.

The implementation of the Fever, Sugar, Swallowing protocol resulted in a notable reduction in the average length of hospital stay. These findings align with the research conducted by Dello et al. (2021), which indicated a decrease in the median length of stay from 5.02 days to 3.47 days following the application of the Fever, hyperglycemia and dysphagia protocol. Conversely, a randomized controlled trial by Sridhar et al. (2024) assessing the effectiveness of nurse-led interventions on clinical outcomes for stroke patients revealed no significant improvement in hospital stay duration. In this study, the intervention group had an average stay of 11 days, compared to 9 days for the control group. Similarly, Middleton et al. (2023) found no difference in length of stay, with both groups exhibiting a median duration of 8 days. From the researchers' perspective, the discrepancies in average length of stay may be attributed to the specific characteristics of the patient samples studied. Nonetheless, the implementation of the Fever, Hyperglycemia & Dysphagia management protocol appears to have positively influenced the reduction of potential adverse events, thereby contributing to a decrease in the overall length of hospital stay.

In the context of functional dependency, the current study revealed that the mean score for the control group was better than in the control group indicating a statistically significant difference between the two groups. Conversely, Sridhar et al. (2024) reported that the functional dependency outcomes, as assessed by the modified Activities of Daily Living (ADL) Barthel Index, did not demonstrate significant differences in the distribution of participants across various categories of dependency between the groups. From the researcher's viewpoint, the discrepancies between the findings of the current study and those reported by Sridhar et al. (2024) concerning functional dependency outcomes may be linked to differences in patient characteristics. The homogeneity of the study population and the specific inclusion criteria may have resulted in the selection of patients with lower acuity levels, which could explain the significant improvements observed in Barthel Index scores.

The current study's analysis revealed that the distribution of disability levels, as measured by the Modified Rankin Score (mRS), exhibited a higher proportion of slight disability in the control group, followed by moderate disability . In contrast, the study group demonstrated an increased prevalence of slight disability and moderately severe disability . Nonetheless, statistical analysis indicated no significant differences in mRS scores between the two groups upon admission. These findings align with those reported by Sridhar et al. (2024), who noted an equivalent proportion of participants without dysfunction (23.1%) in both groups. Their intervention group displayed a dysfunction rate of approximately two-thirds , while the control group had a lower rate of dysfunction at 48.1%. Additionally, mortality rates were higher in the control group compared to the intervention group , although the difference in mRS disability outcomes between the groups was not statistically significant. Middleton et al. (2023) also reported a trend towards worse outcomes on the discharge mRS. However, in a previous study by Middleton et al. (2011), it was found that regardless of stroke severity, patients receiving intervention were significantly less likely to experience death or dependency as indicated by the mRS. From the researchers' perspective, the timing of mRS assessments may contribute to discrepancies observed in research outcomes. Implementing the Fever, Hyperglycemia and dysphagia manageemnt protocol could potentially enhance recovery for individuals with slight disability, aiming for an mRS score of less than 2.

Complications arising in stroke patients are multifaceted and include aspiration pneumonia, deep vein thrombosis (DVT), pressure ulcers, urinary tract infections (UTIs), pulmonary embolism, dehydration, falls, and epilepsy. Statistical analysis of the current study indicates significant disparities in two specific complications: aspiration pneumonia and pressure ulcers. Post-stroke immobility significantly elevates the risk of developing pressure ulcers. Preventive strategies encompass regular repositioning, comprehensive skin assessments, and the application of pressure-relieving devices. Current best practices advocate for a multidisciplinary approach to the prevention and management of pressure ulcers (NPUAP, 2024). While Farid et al. (2022) documented a pressure ulcer incidence of 8.3% in their study, compared to 3% in our Study cohort, highlighting the variability in prevalence rates among stroke patients in tertiary care settings . Moreover, Aspiration pneumonia remains a critical complication in stroke patients, associated with the highest mortality rates among stroke-related conditions. The global incidence of aspiration pneumonia in this population is estimated at approximately 14%. Regionally, this rate varies, with Nigeria reporting an incidence of 12% and Egypt significantly higher at 44% (Belal et al., 2020). From the researcher perspective, the reduction of the incidence of aspiration pneumonia was due to the protocol of swallowing screening for stroke patients which ensure safe feeding for the patients. While the reduction in the incidences of pressure ulcers as the protocol emphasizes frequent monitoring of body temperature and blood glucose levels, which are critical in preventing complications that can exacerbate skin integrity issues.

5. CONCLUSION

Results of the current study indicated that the implementation of the Fever, Hyperglycemia, and Dysphagia management protocol has a positive impact on key patient outcomes in acute stroke care. Specifically, patients in the intervention group exhibited better control over body temperature and blood glucose levels, as well as improved swallowing capabilities as measured by the Gugging Swallowing Screening tool. Additionally, there was a notable reduction in the length of hospital stay and functional dependency among these patients. The study also highlighted a significant decrease in the incidence of aspiration pneumonia and pressure ulcers, which are critical complications associated with stroke recovery. However, no statistically significant difference was observed in the degree of disability among patients, suggesting that while immediate physiological management is beneficial, it may not fully translate into long-term functional improvements.

6. RECOMMENDATIONS

- Hospitals should adopt and implement standardized protocols for managing fever, hyperglycemia, and dysphagia in acute stroke units to enhance patient care.
- Regular audits should be conducted to monitor the effectiveness of these protocols on patient outcomes, focusing on complications such as aspiration pneumonia and pressure ulcers.
- Monitoring levels of functional dependency and disability in stroke patients after their discharge is vital for understanding their recovery progress.
- Encourage collaboration among healthcare professionals including nurses, dietitians, and speech therapists to address all aspects of stroke care comprehensively.
- Additional studies are needed to explore the long-term effects of such management protocols on functional outcomes and quality of life for stroke survivors.
- It would be beneficial to repeat the study with a larger sample size and a broader range of patient characteristics.

7. FUNDING

This research received no external funding.

8. CONFLICT OF INTEREST

No conflict of interest

9. REFERENCES

1. Belal, E. S., Selim, S., Aboul fotouh, A. M., & Mohammad, A. (2020). Detection of airway protective level of the cough reflex in acute stroke patients. The Egyptian Journal of Neurology, Psychiatry and Neurosurgery, 56, 1-6.
2. Brandão, B. C., Silva, M. A. O. M. D., Rodrigues, C. G., Damando, M. D., & Lourenção, L. G. (2020, October). Relationship between oral intake and severity of Acute Stroke. In CoDAS (Vol. 32, p. e20180154). Sociedade Brasileira de Fonoaudiologia.
3. Branyan, T. E., & Sohrabji, F. (2020). Sex differences in stroke co-morbidities. Study neurology, 332, 113384.
4. Dello, S., Lemmens, R., Demeestere, J., Michiels, D., Wellens, L., Weltens, C., ... & Bruyneel, L. (2021). A nurse-led multicomponent intervention supported by advanced electronic health records to improve the acute management of stroke patients: A pre-and post-intervention study. International Journal of Nursing Studies Advances, 3, 100023.

5. Farid, J., Amin, R., Sheikh, M. A., Irfan, M., AlRuwaili, R., Alruwaili, M., ... & Rahman, S. (2022). Prevalence and prediction of pressure ulcers in admitted stroke patients in a tertiary care hospital. Journal of Tissue Viability, 31(4), 768-775.
6. Feigin, V. L., Stark, B. A., Johnson, C. O., Roth, G. A., Bisignano, C., Abady, G. G., ... & Hamidi, S. (2021). Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet Neurology, 20(10), 795-820.
7. Ferrari, F., Moretti, A., & Villa, R. F. (2022). Hyperglycemia in acute ischemic stroke: Physiopathological and therapeutic complexity. Neural Regeneration Research, 17(2), 292.
8. Gittins, M., Lugo-Palacios, D., Vail, A., Bowen, A., Paley, L., Bray, B., & Tyson, S. (2021). Stroke impairment categories: A new way to classify the effects of stroke based on stroke-related impairments. Clinical Rehabilitation, 35(3), 446-458.
9. Griñán, K., Arboix, A., Massons, J., Díez, L., Vergés, E., Gil, F., ... & García-Eroles, L. (2021). Cardioembolic stroke: risk factors, clinical features, and early outcome in 956 consecutive patients. Revista de investigación clínica, 73(1), 23-30.
10. Holland, S. A., Wellwood, I., & Kuys, S. (2024). Effect of abnormal body weight on mortality and functional recovery in adults after stroke: an umbrella review. International Journal of Stroke, 19(4), 397-405.
11. Ibrahim Meneci, T., Hassan El-Sheshiny, A., & Saber Mohamed, M. (2021). Ischemic stroke registry in Egypt: Hospital based study. Al-Azhar Medical Journal, 50(1), 35-46.
12. Jasne, A. S., Chojecka, P., Maran, I., Mageid, R., Eldokmak, M., Zhang, Q., ... & Sharma, R. (2020). Stroke code presentations, interventions, and outcomes before and during the COVID-19 pandemic. Stroke, 51(9), 2664-2673.
13. Jones, A. T., O'connell, N. K., & David, A. S. (2020). Epidemiology of functional stroke mimic patients: a systematic review and meta-analysis. European journal of neurology, 27(1), 18-26.
14. Kariyawasam, P. N., Pathirana, K. D., & Hewage, D. C. (2020). Factors associated with health related quality of life of patients with stroke in Sri Lankan context. Health and quality of life outcomes, 18, 1-10.
15. Kenny, T., Barr, C., & Laver, K. (2016). Management of Fever, Hyperglycemia, and Dysphagia in an Acute Stroke Unit. Rehabilitation Nursing, 41(6), 313-319.
16. Lee, E. J., Kim, S. J., Bae, J., Lee, E. J., Kwon, O. D., Jeong, H. Y., ... & Jeong, H. B. (2021). Impact of onset-to-door time on outcomes and factors associated with late hospital arrival in patients with acute ischemic stroke. PLoS One, 16(3), e0247829.
17. Mergenthaler, P., Dirnagl, U., & Kunz, A. (2022). Ischemic stroke: basic pathophysiology and clinical implication. In Neuroscience in the 21st century: From basic to clinical (pp. 3807-3827). Cham: Springer International Publishing.
18. Middleton, S., Dale, S., McElduff, B., Coughlan, K., McInnes, E., Mikulik, R., ... & Pfeilschifter, W. (2023). Translation of nurse-initiated protocols to manage fever, hyperglycaemia and swallowing following stroke across Europe (QASC Europe): A pre-test/post-test implementation study. European Stroke Journal, 8(1), 132-147.
19. Middleton, S., McElduff, P., Ward, J., Grimshaw, J. M., Dale, S., D'Este, C., ... & Levi, C. (2011). Implementation of evidence-based treatment protocols to manage fever, hyperglycaemia, and swallowing dysfunction in acute stroke (QASC): a cluster randomised controlled trial. The Lancet, 378(9804), 1699-1706.
20. Middleton, S., McElduff, P., Ward, J., Grimshaw, J. M., Dale, S., D'Este, C., ... & Levi, C. (2011). Implementation of evidence-based treatment protocols to manage fever, hyperglycaemia, and swallowing dysfunction in acute stroke (QASC): a cluster randomised controlled trial. The Lancet, 378(9804), 1699-1706.
21. Miller, C., Gibson, J. M., Jones, S., Timoroska, A. M., Maley, A., Romagnoli, E., ... & Watkins, C. L. (2023). How is hydration assessed and managed in acute stroke? A qualitative study of healthcare staff's knowledge, attitudes and experiences. Journal of Clinical Nursing, 32(7-8), 1089-1102
22. Nasreldein, A., Walter, S., Mohamed, K. O., Shehata, G. A., Ghali, A. A., Dahshan, A., ... & Abd-Allah, F. (2023). Pre-and in-hospital delays in the use of thrombolytic therapy for patients with acute ischemic stroke in rural and urban Egypt. Frontiers in Neurology, 13, 1070523.
23. National Pressure Ulcer Advisory Panel (NPUAP). (2024). Prevention and Treatment of Pressure Ulcers. NPUAP Guidelines https://npiap.com/page/InternationalGuidelines
24. Ruksakulpiwat, S., Zhou, W., Phianhasin, L., Benjasirisan, C., Salehizadeh, S., Wang, L., & Voss, J. G. (2023). Associations between diagnosis with stroke, comorbidities, and activity of daily living among older adults in the United States. Chronic diseases and translational medicine, 9(02), 164-176.

25. Shokri, H. M., El Nahas, N. M., Aref, H. M., Dawood, N. L., Abushady, E. M., Abd Eldayem, E. H., ... & Roushdy, T. M. (2020). Factors related to time of stroke onset versus time of hospital arrival: A SITS registry-based study in an Egyptian stroke center. PLoS One, 15(9), e0238305.
26. Soto-Cámara, R., González-Bernal, J. J., González-Santos, J., Aguilar-Parra, J. M., Trigueros, R., & López-Liria, R. (2020). Age-related risk factors at the first stroke event. Journal of clinical medicine, 9(7), 2233.
27. Sridhar, D., Ramamoorthy, L., Narayan, S. K., Amalnath, D., Lalthanthuami, H. T., Ganapathy, S., & Puliyakkuth, U. (2024). Effectiveness of nurse-led fever, sugar-hyperglycemia, and swallowing bundle care on clinical outcome of patients with stroke at a tertiary care center: A randomized controlled trial. Journal of Neurosciences in Rural Practice, 15(2), 255.
28. Tork, M. A., Aref, H. M., El-Khawas, H. M., Khalil, M. F., & ElSadek, A. (2020). Outcome predictors of intravenous thrombolytic therapy in acute ischemic stroke patients: an Egyptian center experiences. The Egyptian Journal of Neurology, Psychiatry and Neurosurgery, 56, 1-10.
29. Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., ... & Bhutta, Z. A. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet, 396(10258), 1204-1222.
30. Webb, A. J., & Werring, D. J. (2022). New insights into cerebrovascular pathophysiology and hypertension. Stroke, 53(4), 1054-1064.
31. Xie, J., Li, C., & Shi, M. (2024). Correlation between marital status and the prognosis of older patients with cerebrovascular disease in intensive care units: A retrospective cohort study. Health Science Reports, 7(6), e2177.
32. Yang, S., Choo, Y. J., & Chang, M. C. (2021, December). The preventive effect of dysphagia screening on pneumonia in acute stroke patients: a systematic review and meta-analysis. In Healthcare (Vol. 9, No. 12, p. 1764). MDPI.
33. Gunawardhana, C. (2021). Post-Stroke Complications and Prognostication. Guide to Stroke Rehabilitation for Healthcare Professionals, 20.