Effect of Clinical Pathway Application on Stroke Patients' Outcomes

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Abstract

A clinical pathway is a process for managing patient by states the goal and main elements of care based on Evidence Based guidelines, best intervention to enhance quality of care; outcomes and reduce length of patient's hospitalization.

Aim of the Study: To evaluate the effect of clinical pathway applications on stroke patients' outcomes.

Design: Quasi-experimental design was used to test the research hypothesis.

Subjects: A purposive sample of 78 patients, they divided randomly and alternatively into two equal groups 38 patients in each as follows: (1)The study group (I): received their care by application of clinical pathway (2) The control group (II): received routine hospital care.

Setting: The current study was conducted at Emergency, Intensive Care Unit and Medical ward at Menoufia University Hospital; Menoufia Governorate; Egypt. ***Tools for data collection:*** four tools were utilized by the researchers to achieve the aim of the study and to collect the necessary data. ***Tool (I):*** Semi structured questionnaire (demographic and medical data Sheet); ***Tool (II):*** bio- physiological measurements (indicators of improved patients' outcomes); ***Tool (III):*** National Institutes of Health Stroke Scale, or NIH Stroke Scale (NIHSS); and ***Tool (IV):*** Multidisciplinary planned sheet team.

Results: There was improvement in values of vital signs, oxygen saturation, central venous pressure, arterial blood gases interpretation, central venous pressure, blood glucose level during the last measurements after applying clinical pathway in study group compared to control group, also there was a highly statistical significant difference between two groups regarding to post stroke complications. Additionally there was highly statistical significance difference between them stroke severity. Shorten length of stay in hospital in study group compared to control due to improvement in study group outcomes.

Conclusion: clinical pathway has a positive effect on reducing length of patient's hospitalization stay, and early improvement in patients' outcomes with apparent positive effect on quality of patient care.

Recommendation: The researchers recommended that; application of clinical pathway on large samples and variable measurements are in need to generalization of the results. Clinical pathway should be carried out routinely for managing stroke patients in intensive care unit.

Keywords: *Clinical Pathway; Stroke; Clinical Outcomes; Hospitalization Length (Hospital stay).*

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List of Abbreviation: Intensive Care Unit (ICU); Central venous pressure (CVP); Arterial Blood Gases (ABGs).

Introduction

Stroke is a main reason of death and disability worldwide, about 795,000 people suffering from an acute stroke yearly. In Egypt, according to recent estimates, the total incidence of stroke is 963/100 000 populations[1]. There are two types of stroke ischemic and hemorrhagic. The highest reason of ischemic stroke that lead to impaired blood flow to brain is atherosclerosis, while hemorrhagic stroke due to rupture of blood vessel account 68% of death[2 & 3].

Manifestations of stroke occurs suddenly which including numbness, weakness or paralysis on one side of body, drooping lower eyelid or mouth, slurred speech, or difficulty finding words or understanding speech, abrupt blurred vision or loss of sight, confusion or unexpected, severe headache. But the symptoms of stroke depend on the region of the brain that has been influenced and the extent of damaged [4].

Appropriate and quick management is important to determine subsequent outcomes, as the brain tissue is possibly under the hazard of death within the first few hours following the beginning of ischemia. In severe condition, the central of the infarction will die due to severe ischemia. While, surrounding tissue can survive if suitable treatment is done. In this situation, hemodynamic stability, good oxygenation, and metabolic factors are crucial to regulate the outcome [5].

Complications of stroke are significant problem that will affect later outcomes. Usually, the presence of high body temperature, hyperglycemia, and/or elevation of blood pressure is accompanied with poor outcomes. So, elevate glucose levels should be controlled, and hyperthermia should be treated with Paracetamol [6].

Estimates of the frequency of medical complications in people post stroke range from 24.2% to 95%.1, In the acute phase post-stroke, medical complications can include dysphagia, cardiac problems and pneumonia, while other complications such pressure ulcer and venous thrombosis may happen later in the stroke [7 & 8].

Nursing has a crucial role toward patients with stroke, because nursing care include 24 hours a day that lead to spend more time bedside patient, additionally nurses can assess patient 'condition, record, report and evaluate the effect of treatment. If nurses be more acquainted with the complications of stroke, with early detection of it can play an important role in care that lead to early treatment and prevention of these complications[9 & 10].

A clinical pathway is a process for managing patient by states the goal and main elements of care based on Evidence Based guidelines, best intervention and patient expectations through good communication, coordinating roles and arrange the activities of the multidisciplinary care team, documenting, monitoring and evaluating variances; and also providing the necessary resources to be used more efficiently to enhance quality of care and outcomes [11 & 12].

Management of stroke requires specialized trained staff working competently within a well-equipped and well arranged, clinical pathway has many advantages when applying it for patient with stroke which leads to improve quality of care. Hence; Clinical pathways have a positive effect on patient outcomes, shorten length of stay in hospital, hospital costs and professional practice[13].

Nurses have a main role in all steps of a clinical pathway use. Participating in the development of the pathway is the first step. Because they begin and end the chain of staff involved in delivering care, nurses own a unique perspective in how health care systems work to improve the quality of care [14].

Significance of the Study:

Stroke is the major healthcare problems in developing and developed nations. Around the world it is the second cause of mortality and permanent disability. Management of patients had stroke necessitates a multidisciplinary management team and tool which is established on evidence-based practices as a clinical pathway; which delivering an organized stroke care to reduce early mortality; disability and improves patients' outcomes.

Aim of the Study: To evaluate the effect of clinical pathway applications on stroke patients' outcomes.

Research Hypothesis:

1. There will be improvement in patients' Outcomes in study group compared to control group after applying clinical pathway.
2. The length of hospitalization will decrease in study group after applying clinical pathway compared to control group.

Subjects and Method

Research Design: Quasi-experimental design was used to test the research hypothesis.

Research Setting: The current study was conducted at Emergency, ICU and medical ward at Menoufia University Hospital; Menoufia Governorate; Egypt.

Sample: A purposive sample of 78 patients who arrived into emergency unit of Menoufia University hospital and they were diagnosed of stroke, then admitted to ICU, their family agreed to participate in the study and fulfill the inclusion criteria. The study subjects were divided randomly and alternatively into two equal groups 38 patients in each as follows: 1-The study group (I): received their care by application of clinical pathway 2- The control group (II): received routine hospital care.

- **Inclusion criteria:** a) Adult Patients from sexes, b) diagnosed at first time with stroke.
- **Exclusion criteria:** patients with previous traumatic brain injury, impaired in cognitive,impaired immobility, pressure ulcer.

Sample Size: Based on a previous literature by (**Shahzad and Ahmed, 2013**)[15]; with a power of the study, 90% and a confidence level, 95%, the calculated sample size for this randomized controlled clinical trial study rendered 78 subjects which were divided into two groups after doing randomization so each group consists of 38 patients.

Tools for data collection: Four tools were utilized by the researchers to achieve the aim of the study and to collect the necessary data.

Tool (I): Semi structured questionnaire (demographic and medical data Sheet); as age, gender, smoking, type of stroke, comorbidities and necessary performed interventions.

Tool (II): Bio-physiological measurements (indicators of improved patients' outcomes) which included the following; vital signs; oxygen saturation, central venous pressure, laboratory results arterial blood gases (acid base status) and blood glucose level, length of hospitalization; and incidence of complications during hospitalization.

Tool (III): National Institutes of Health Stroke Scale, or NIH Stroke Scale (NIHSS); it is a tool developed by stroke neurologists from the University of Cincinnati, the University of Iowa and the National Institutes of Health-National Institute of Neurological Disorders, it used by healthcare providers for assessment of stroke severity. The NIHSS is composed of 11 items, scale with potential scores ranging from 0 to 31. Reliability of the NIHSS is (intraclass correlation coefficient=0.92 and 0.96); validity is (r = 0.72) [16].

Tool (IV): Multidisciplinary planned sheet team for establishing plan of care for following the continuity of care and treatment; and establishing discharge plan.

Content validity and reliability: Before starting, the data collection tools were tested for its content validity by a group of experts in the medical-surgical nursing and critical care nursing to ascertain relevance, completeness, coverage of the content and clarity of the tools. The required modification was carried out accordingly. Furthermore, it was tested for reliability by calculating their internal consistency using Cronbach's alpha coefficient method. This turned to be $\alpha = 0.97$.

Pilot Study: was done by 10 % of stroke's patient and before starting the actual data collection. Subjects who participated in the pilot study were included in the study sample.

Human rights and ethical considerations: An official permission was taken from the authoritative personal in the hospital. The researchers introduced themselves to the patients' family who met the inclusion criteria and informed them about the aim of the current study, an oral consent was obtained from them. Confidentiality and anonymity of them were assured through coding the data.

Processing and application of clinical pathway: Data collection for this study was carried out by permission from administrative personnel of Menoufia university Hospital. The data collection period started from September 2019 to March 2020.

The clinical pathway for stroke's patients consisted of a paper document in patients' sheet, started from emergency department until patients 'discharge. It contained general instructions about stroke management and then meticulous daily activities for each phase of clinical pathway (the researchers used both the day and phase type pathway). The multidisciplinary care team (medical staff, nurses, physiotherapist, Vascular Neurology, Occupational therapy, Speech therapy, Pharmacy, dietitian, laboratory investigation, radiology

and social workers). The researcher set up the guidelines of plan of care and distributed the role for each one on the multidisciplinary care team; the care plan included the essential practices.

During the period of data collection the researchers presented daily with the clinical pathway team at intensive care unit except the Friday to perform standardized care which needed for stroke's patients; these care included monitoring hemodynamic status and tissue perfusion by noninvasive technique as measuring vital signs with recording at follow up sheets and measuring fluid intake and output hourly; other method by invasive technique measuring central venous pressure as indicator for hydration and fluid status.

Planned activities and discharge planning; each point should be written, achieved by staff on a daily basis and regular meetings of a stroke pathway team and report to follow patients' progress. The intervention had timeframes and aimed to standardize care for a specific clinical problem as ECG arrhythmias; fever, hyperglycemia, and hypertension, prophylaxis for thromboembolism, use of investigations (computed tomography or magnetic resonance imaging, beside air way management, nutrition in addition to usual care to improve patients 'condition.

As regards ventilation by checking and follow up arterial blood gases and its interpretation to promote early weaning from mechanical ventilation; maintained a clear airway by daily chest assessment; performed the ordered needed suction based on evidence guidelines.

Regarding to skin integrity by every two hours position changing, maintain skin dry and clean; daily assessing skin with care and massage; with an early management for patient had pressure ulcer and a proper oral care to maintain oral health.

In relating to patient's hygiene and infection control the following procedures applied daily care for urinary catheter; perineal care by a proper technique, partial bed bath, eye care by correct method followed by applying ointment and covering patient's eyes to prevent corneal ulcer; the clinical pathway team performed all procedures based on infection control measures.

Concerning to stroke severity calculated by National Institutes of Health Stroke Scale to identify patients' response and prognosis; otherwise daily assessing of consciousness level by GCS; and performed coma arousal technique to assist patients in returning to consciousness level; followed up documentation on follow up sheet for continuous communication between the team.

Regarding to nutritional status the researchers administered a prescribed formula and intravenous fluid with reviewing and followed up blood glucose level for controlling hyperglycemia; a proper nutritional status the researchers performed daily assessment for gastro-intestinal tract for early management for any disturbances.

In relation to complication and length of hospitalization; the researchers established a planned team care which included early identification and management of specific complications. Moreover document discharge plan for secondary prevention and treatment as controlling blood pressure and treatment, smoking cessation programme, controlling blood glucose level, cholesterol lowering medication, anti-platelet treatment, anticoagulation for atrial fibrillation).

The researchers followed patient's condition, and documented five measurements in patient's sheet then comparison between result to identify progress of patient 'condition and outcome.

Statistical methodology: The data collected were tabulated & analyzed by SPSS (statistical package for the social science software) statistical package version 20 on IBM compatible computer [17].

Two types of statistics were done:

1. **Descriptive statistics:** were expressed as mean and standard deviation (X+SD) for quantitative data or number and percentage (No & %) for qualitative data.
2. **Analytic statistics:**

1. Pearson Chi-square test (χ^2) & Fisher`s Exact Test: It is the test of significance used to study association between two qualitative variables.
2. Student t- test (parametric test): is a test of significance used for comparison between two independent groups of normally distributed quantitative variables.
3. Mann-whitney (non- parametric test): is a test of significance used for comparison between two independent groups of not normally distributed quantitative variables.

4. Repeated-Measures ANOVA: is a test of significance used when we had a single line of data for each participant, with the repeated measures entered as separate variables on that same line (used for comparison between more than two related groups of normally distributed quantitative variables). Post hoc tests are run to confirm where the differences occurred between groups, they are only run when we had an overall statistically significant difference in group means (i.e., a statistically significant one-way ANOVA result).

P-value at 0.05 was used to determine significance regarding:

- P-value > 0.05 to be statistically insignificant.
- P-value ≤ 0.05 to be statistically significant.
- P-value ≤ 0.001 to be highly statistically significant.

Results

Table (1): Distribution of demographic characteristics and medical data of the studied groups:

Demographic characteristics and medical data	Studied groups				χ2	P value
	Study group (n=38)		Control group (n=38)			
	No.	%	No.	%		
Age (years):						
Mean ± SD	52.66±3.31		52.05±3.27		**t-test=**	0.42
Range	44.0–57.0		47.0–59.0		0.80	NS
Sex:						
Male	20	52.6	15	39.5	1.32	0.25
Female	18	47.4	23	60.5		NS
Smoking:						
Yes	18	47.4	13	34.2	1.36	0.24
No	20	52.6	25	65.8		NS
Type of stroke:						
Ischemic	25	65.8	24	63.2	0.05	0.81
Hemorrhagic	13	34.2	14	36.8		NS
Comorbidities:						
Diabetes	17	44.7	19	50.0		
Hypertension	11	28.9	12	31.6	7.92	0.04
Cardiac disease	0	0.0	4	10.5		S
Dyslipidemia	10	26.3	3	7.9		
Intervention: the patients are treated by (placed on)						
Oxygen therapy	4	10.5	3	7.9	0.15	1.0*
Mechanical ventilation	34	89.5	35	92.1		NS

χ2: chi square test, t-test: students` t test, NS: not significant, *Fisher`s exact test, S: significant

Table (1) showed that; more than half of studied sample at the mean age of (52.66 ± 3.31 & 52.05 ±3.27) in study & control group respectively. More than half of study group (52.6%) was male, while (60%) were female in control group. More than half of studied sample had Ischemic stroke. Additionally most of studied sample placed on mechanical ventilation (89.5 & 92.1) in study & control respectively.

Table (2): Physiological parameters (vital signs) of the studied groups before and after application of clinical pathway:

Physiological parameters (vital signs)	Studied groups		Students` t test	P value
	Study group (n=38)	Control group (n=38)		
	Mean ±SD	Mean ±SD		
Respiratory rate First measure (initial)	10.71 ± 1.01	10.24 ± 0.99	2.05	0.04 S
Second measure	12.18 ± 0.60	12.13 ± 0.47	0.42	0.67 NS
Third measure	14.16 ± 0.49	13.92 ± 0.27	2.58	0.01 S
Fourth measure	17.87 ± 2.18	14.92 ± 2.34	5.67	<0.001 HS
Fifth measure	19.61 ± 1.49	18.26 ± 2.95	2.49	0.01 S
Repeated-measures analyses of variance	**F=**369.18	**F=**138.65		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=<0.001 P6=<0.001 P2=<0.001 P7=<0.001 P3=<0.001 P8=<0.001 P4=<0.001 P9=<0.001 P5=<0.001 P10=<0.001		P1=<0.001 P6=<0.001 P2=<0.001 P7=<0.001 P3=<0.001 P8=0.01 P4=<0.001 P9=<0.001 P5=<0.001 P10=<0.001	
Pulse rate First measure (initial)	65.66 ± 4.67	67.11 ± 7.03	1.05	0.29 NS
Second measure	65.39 ± 4.70	63.55 ± 5.44	1.57	0.11 NS
Third measure	68.16 ± 4.25	64.74 ± 5.44	3.05	0.003 S
Fourth measure	71.37 ± 3.42	65.34 ± 5.38	5.81	<0.001 HS
Fifth measure	74.82 ± 3.41	65.87 ± 5.57	8.44	<0.001 HS
Repeated-measures analyses of variance	**F=**88.82	**F=**9.26		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=0.32 P6=<0.001 P2=<0.001 P7=<0.001 P3=<0.001 P8=<0.001 P4=<0.001 P9=<0.001 P5=<0.001 P10=<0.001		P1=<0.001 P6=0.001 P2=0.009 P7=<0.001 P3=0.03 P8=0.02 P4=0.13 P9=0.006 P5=0.002 P10=0.02	

U: Mann-whitney, HS: highly significant, *Fisher`s exact test, NA: not applicable

P1: comparison between first measure & second measure

P2: comparison between first measure & third measure

P3: comparison between first measure & fourth measure

P4: comparison between first measure & fifth measure

P5: comparison between second measure & third measure

P6: comparison between second measure & fourth measure

P7: comparison between second measure & fifth measure

P8: comparison between third measure & fourth measure

P9: comparison between third measure & fifth measure

P10: comparison between fourth measure & fifth measure

Table (2) revealed that; there was improvement in values of respiratory and heart rates during the third, fourth and fifth measurement after applying clinical pathway in study group compared to control group. Also there was highly statistical significant difference between two groups at fourth measure related pulse & respiratory rate (P<0.001).

Continuous Table (2): Physiological parameters (vital signs) of the studied samples before and after application of clinical pathway:

Physiological parameters (vital signs)	Studied groups		Students` t test	P value
	Study group (n=38)	Control group (n=38)		
	Mean ±SD	Mean ±SD		
Systolic blood pressure First measure (initial)	141.97 ± 14.40	143.55 ± 15.41	0.46	0.64 NS
Second measure	144.61 ± 13.22	143.55 ± 15.41	0.31	0.75 NS
Third measure	136.58 ± 19.93	141.84 ± 13.37	1.35	0.18 NS
Fourth measure	133.68 ± 6.74	138.68 ± 9.70	2.60	0.01 S
Fifth measure	132.63 ± 5.54	137.76 ± 8.51	3.11	0.003 S
Repeated-measures analyses of variance	**F**=12.95	**F**=20.90		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=0.002 P6=<0.001 P2=0.04 P7=<0.001 P3=<0.001 P8=0.31 P4=<0.001 P9=0.18 P5=0.007 P10=0.03		P1=NA P6=<0.001 P2=0.001 P7=<0.001 P3=<0.001 P8=<0.001 P4=<0.001 P9=<0.001 P5=0.001 P10=0.006	
Diastolic blood pressure First measure (initial)	93.95 ± 9.59	95.92 ± 8.99	0.92	0.35 NS
Second measure	97.37 ± 7.42	96.18 ± 8.88	0.63	0.53 NS
Third measure	94.34 ± 6.38	95.39 ± 8.16	0.62	0.53 NS
Fourth measure	91.05 ± 5.59	93.82 ± 7.01	1.89	0.06 NS
Fifth measure	88.95 ± 4.52	93.16 ± 5.97	3.46	0.001 HS

Physiological parameters (vital signs)	Studied groups		Students` t test	P value
	Study group (n=38)	Control group (n=38)		
	Mean ±SD	Mean ±SD		
Repeated-measures analyses of variance	**F**=39.09	**F**=14.81		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=<0.001 P6=<0.001 P2=0.62 P7=<0.001 P3=0.001 P8=<0.001 P4=<0.001 P9=<0.001 P5=<0.001 P10=<0.001		P1=0.16 P6=<0.001 P2=0.10 P7=<0.001 P3=0.001 P8=0.001 P4=<0.001 P9=<0.001 P5=0.01 P10=0.06	
Body temperature First measure (initial)	36.97 ±0.29	37.06 ± 0.29	1.36	0.17 NS
Second measure	38.47 ±0.52	38.52 ± 0.53	0.36	0.71 NS
Third measure	37.91 ± 0.77	37.97 ± 0.59	0.41	0.67 NS
Fourth measure	37.18 ± 0.60	37.47 ± 0.55	2.16	0.03 S
Fifth measure	36.66 ± 0.53	37.04 ± 0.43	3.38	0.001 HS
Repeated-measures analyses of variance	**F**=70.14	**F**=81.18		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=<0.001 P6=<0.001 P2=<0.001 P7=<0.001 P3=0.04 P8=<0.001 P4=0.007 P9=<0.001 P5==<0.001 P10=0.001		P1=<0.001 P6=<0.001 P2=<0.001 P7=<0.001 P3=<0.001 P8=<0.001 P4=0.72 P9=<0.001 P5=<0.001 P10=<0.001	

Table (2) showed that; there was statistically significant in values of systolic blood pressure in study group compared to control group at fourth and fifth measurement P (0.01 & 0.003). Moreover there was highly statistical significant difference related to Diastolic blood pressure at Fifth measure

(P =0.001). Regarding to body temperature there was highly statistical significant difference in study group compared to control group at Fifth measurement (P =0.001).

Table (3): Oxygen saturation between studied samples before and after application of clinical pathway:

Oxygen saturation	Studied groups		Students` t test	P value
	Study group (n=38)	Control group (n=38)		
	Mean ±SD	Mean ±SD		
Oxygen saturation First measure (initial)	76.05 ± 3.70	75.13 ± 4.86	0.92	0.35 NS
Second measure	80.92 ± 1.76	79.16 ± 3.09	2.96	0.004 S

Oxygen saturation	Studied groups		Students` t test	P value
	Study group (n=38)	Control group (n=38)		
	Mean ±SD	Mean ±SD		
Third measure	83.97 ± 2.14	82.02 ± 3.90	2.69	0.009 S
Fourth measure	86.68 ± 2.20	85.16 ± 3.59	2.22	0.02 S
Fifth measure	91.42 ± 1.75	90.13 ± 1.09	3.85	<0.001 HS
Repeated-measures analyses of variance	**F=**211.82	**F=**135.10		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=<0.001 P6=<0.001 P2=<0.001 P7=<0.001 P3=<0.001 P8=<0.001 P4=<0.001 P9=<0.001 P5=<0.001 P10=<0.001		P1=<0.001 P6=<0.001 P2=<0.001 P7=<0.001 P3=<0.001 P8=<0.001 P4=<0.001 P9=<0.001 P5=<0.001 P10=<0.001	

(Note: frequency of measurements for table 2, cont. table 2 & 3) First measure (initial) at emergency unit, Second measure at first day at ICU, Third measure at third day at ICU, Fourth measure before discharge from ICU and Fifth measure at ward).

Table (3) illustrated that; there was improvement in the mean oxygen saturation in study group compared to control at different interval measurement, with highly statistical significant difference between them at fifth measure P (<0.001).

Table (4): Arterial blood gases interpretation between studied groups before and after application of clinical pathway

Arterial blood gases interpretation	Studied groups				χ^2	P value
	Study group (n=38)		Control group (n=38)			
	No.	%	No.	%		
Acid base imbalance						
First measure						
Resp. acidosis	6	15.8	14	36.8		
Resp. alkalosis	13	34.2	11	28.9		
Metabolic acidosis	19	50.0	11	28.9		
None	0	0.0	2	5.3		0.05
On broad line	0	0.0	0	0.0	7.50	S
Second measure						
Resp. acidosis	5	13.2	13	34.2		
Resp. alkalosis	9	23.7	7	18.4		
Metabolic acidosis	6	15.8	7	18.4		
None	13	34.2	6	15.8		0.16
On broad line	5	13.2	5	13.2	6.46	NS
Third measure						
Resp. acidosis	0	0.0	5	13.2		
Resp. alkalosis	3	7.9	5	13.2		
Metabolic acidosis	1	2.6	4	10.5		
None	24	63.2	8	21.1		0.002
On broad line	10	26.3	16	42.1	16.68	S

Arterial blood gases interpretation	Studied groups				χ^2	P value
	Study group (n=38)		Control group (n=38)			
	No.	%	No.	%		
Fourth measure Resp. acidosis	0	0.0	0	0.0		
Resp. alkalosis	0	0.0	0	0.0		
Metabolic acidosis	0	0.0	0	0.0		
None	35	92.1	20	52.6		<0.001
On broad line	3	7.9	18	47.4	14.80	HS
χ^2	112.07		82.53			
P value	<0.001 HS		<0.001 HS			

(Note: First measure at first day at ICU, Second measure at second day at ICU, Third measure at third day at ICU, Fourth measure before disconnection of endotracheal tube).
U: Mann-whitney, HS: highly significant, *Fisher`s exact test, NA: not applicable
P1: comparison between first measure & second measure
P2: comparison between first measure & third measure
P3: comparison between first measure & fourth measure
P4: comparison between first measure & fifth measure
P5: comparison between second measure & third measure
P6: comparison between second measure & fourth measure
P7: comparison between second measure & fifth measure
P8: comparison between third measure & fourth measure

Table (4) documented that; at first measurement about 50% from study group had metabolic acidosis**;** and 36.8% from control group had respiratory acidosis. While at fourth measure 92.1% from study and more than half of control group (52.6%) hadn't any acid base disturbance respectively .Also there was highly significant difference between study and control group P(<0.001).

Table (5) Blood glucose level among studied groups before & after application of clinical pathway:

Blood glucose level	Studied groups		Mann-Whitney test	P value
	Study group (n=38)	Control group (n=38)		
	Mean ±SD	Mean ±SD		
Blood glucose First measure	191.18 ± 95.29	202.24 ± 99.50	0.21	0.83 NS
Second measure	171.32 ± 74.74	188.55 ± 85.15	0.93	0.35 NS
Third measure	148.95 ± 50.52	170.13 ± 66.70	1.82	0.06 NS
Fourth measure	131.84 ± 32.90	153.42 ± 50.44	2.01	0.04 S
Repeated-measures analyses of variance	**F**=28.66	**F**=32.63		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=<0.001 P8=<0.001 P2=<0.001 P3=<0.001 P5=<0.001 P6=<0.001		P1=<0.001 P8=<0.001 P2=<0.001 P3=<0.001 P5=<0.001 P6=<0.001	

(Note: First measure at first day at ICU, Second measure at second day at ICU, Third measure before discharge from ICU, Fourth measure at ward).

Table (5) stated that; there was improvement in blood glucose level at fourth measurement in study group compared to control group after application of clinical pathway. Moreover there was statistical significant difference P=0.04.

Table (6): Hemodynamic monitoring (Central venous pressure) among studied groups before & after application of clinical pathway

Hemodynamic monitoring	Studied groups		Students` t test	P value
	Study group (n=38)	Control group (n=38)		
	Mean ±SD	Mean ±SD		
CVP (Mean ± SD) First measure	4.97 ± 0.63	4.89 ± .72	0.50	0.61 NS
Second measure	5.82 ± 0.65	5.39 ± 0.49	3.17	0.002 S
Third measure	7.0 ± 0.83	5.82 ± 0.51	7.43	<0.001 HS
Fourth measure	8.87 ± 0.90	7.21 ± 0.77	8.56	<0.001 HS
Repeated-measures analyses of variance	243.37	126.04		
P value	<0.001 HS	<0.001 HS		
Post hoc test	P1=<0.001 P2=<0.001 P3=<0.001 P5=<0.001 P6=<0.001 P8=<0.001	P1=<0.001 P2=<0.001 P3=<0.001 P5=<0.001 P6=<0.001 P8=<0.001		

(Note: First measure at first day after insertion of central line at ICU, Second measure at second day, Third measure at third day at ICU, Fourth measure before removing of central line).

Table (6) revealed that; there was no significant difference between both groups in mean of central venous pressure during first measurement, while presence of improvement in the mean of central venous pressure of study group than control group during the last three measurements with significant difference.

Table (7): Distribution of post stroke complications of studied samples during hospitalization period:

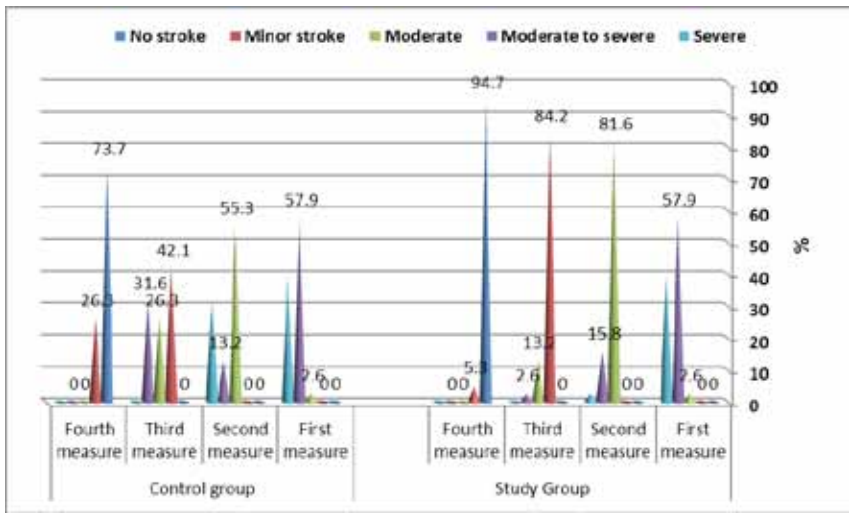
Post stroke complications	Studied groups				χ2	P Value
	Study group (n=38)		Control group (n=38)			
	No.	%	No.	%		
Skin integrity **First measure** Intact	38	100.0	38	100.0	NA	NA
Not intact	0	0.0	0	0.0		
Second measure Intact	38	100.0	38	100.0	NA	NA
Not intact	0	0.0	0	0.0		

Post stroke complications	Studied groups				χ2	P Value
	Study group (n=38)		Control group (n=38)			
	No.	%	No.	%		
Third measure Intact	10	26.3	5	13.2		
Not intact	28	73.7	33	86.8		0.14
If not intact (stages of pressure ulcer)	28	100.0	18	54.5	2.07	NS
First degree	0	0.0	15	45.5	16.87	<0.001
Second degree	0	0.0	0	0.0		HS
Third degree						
Fourth measure Intact	30	78.9	5	13.2		
Not intact	8	21.1	33	86.8		<0.001
If not intact (stages of pressure ulcer)	8	100.0	25	75.8	33.10	HS
First degree	0	0.0	8	24.2	2.40	0.12
Second degree	0	0.0	0	0.0		NS
Third degree						
χ2	76.29		116.65			
P value	<0.001 HS		<0.001 HS			
Patient complications:						
Dehydration	5	13.2	3	7.9		
Chest infection	6	15.8	7	18.4		
Dehydration & Chest infection	0	0.0	5	13.2	20.08	0.001
Seizures	2	5.3	5	13.2		HS
UTI	1	2.6	9	23.7		
No	24	63.2	9	23.7		

(Note: First measure at third day after occurrence of pressure ulcer at ICU, Second measure at second day, Third measure at third day, Fourth measure before discharge from ward).

Table (7) presented that; there was highly statistically significant difference between study and control group at third and fourth measure P (<0.001). Additional more than half of patients in study group had not complications, but about 23.7 % of patients had urinary tract infection in control group. There was a highly statistical significant difference between two groups regarding to complications post stroke P (0.001).

Figure (1): National Institutes of Health Stroke Scale of the studied groups before and after application of clinical pathway (Stroke severity):



(Note: First measure at first day at ICU, Second measure at second day at ICU, Third measure at third day at ICU, Fourth measure before discharge from ICU).

Figure (1) revealed that; there was presence of statistical significant differences between study and control groups in second, third and fourth measurements P (0.003, <0.001 and 0.01) respectively. Otherwise highly statistical significant differences during four measurements related to stroke severity.

Table (8): Multidisciplinary team of the studied groups:

Multidisciplinary team	Studied groups				χ^2	P value
	Study group (n=38)		Control group (n=38)			
	No.	%	No.	%		
Establishing discharge plan:						
Just some oral instructions by nurse	0	0.0	28	73.7	76.0	<0.001 HS
Included into care plan but not done	0	0.0	10	26.3		
Included into care plan & properly done	38	100.0	0	0.0		
Establishing multi-disciplinary team work:						
Not Planned	0	0.0	29	76.3	46.89	<0.001 HS
Planned from the beginning of patient admission	38	100.0	9	23.7		
Continuity of care and treatment:						
Not continuity of care	0	0.0	29	76.3	46.89	<0.001 HS
Continuity of care	38	100.0	9	23.7		

Table (8) revealed that; there was highly statistical significant differences between study and control groups in all issues of multidisciplinary team work P (<0.001).

Figure (2): Duration of hospitalization of the studied groups:

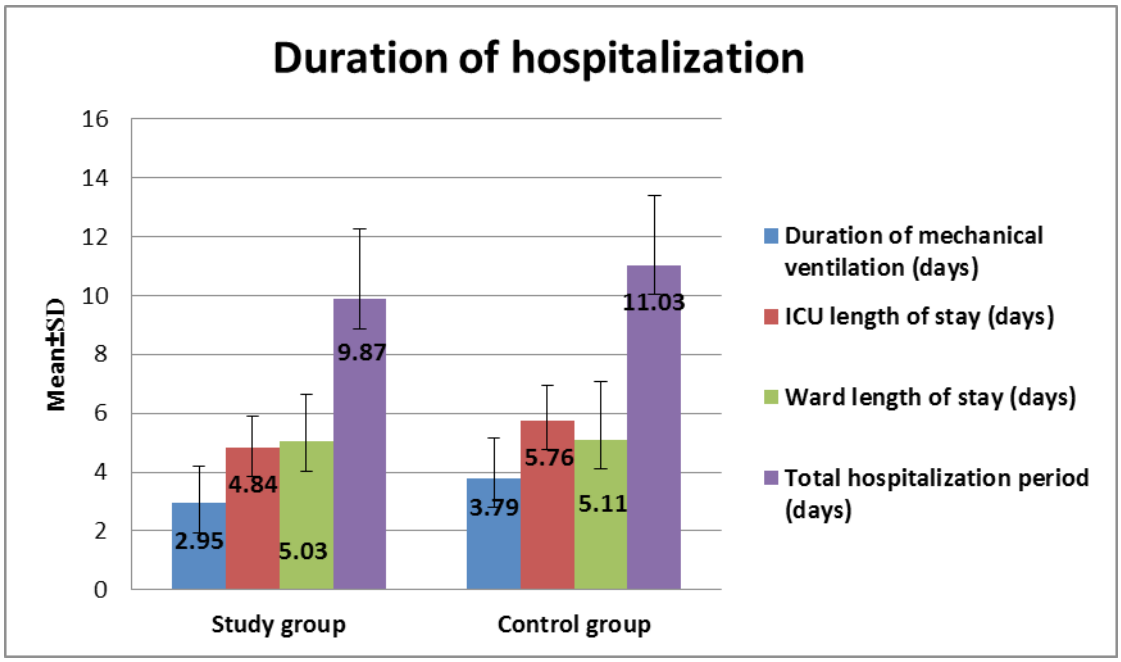


Figure (2) clarified that; lowering the duration of mechanical ventilation, ICU stays length in study group compared to control.

Discussion

A clinical pathway is one of the central tools used to achieve the quality in healthcare concerning the standardization of care practices. Clinical pathways aim to promote organized and efficient patient care based on evidence-based medicine, and **aim the study:** To evaluate the effect of clinical pathway applications on stroke patients' outcomes.

4.1 As regards to demographic characteristics and medical data: The current study stated that; the most common type of stroke among both groups was ischemic stroke; the result consistent with the study conducted by [18] they reported that; ischemic stroke is the greatest type among patients**.** The present study revealed that; diabetes mellitus is the most common comorbidity for incidence of stroke among both groups; this result agreed with [19] who said that**;** hyperglycemia is the major risk factor of stroke incidence. The researchers explained that; increase glucose level leads to vascular endothelial dysfunction, increased early-age arterial stiffness, and systemic inflammation**.**

4.2 Concerning to effect of clinical pathway application on patients' outcomes: The current study approved that; presence of improvement in patients' outcomes among the study group as vital signs, oxygen saturation, arterial blood gases interpretation, duration of mechanical ventilation, central venous pressure (indicator for fluid status) and blood glucose level than control group by the positive effect of clinical pathway application; these improvements in patients' outcomes confirmed by radiological imaging; these results in line with [20] who stated that; the application of clinical pathway had an effective improvement among stoke patients than patients received their care by routine method with significant patients' satisfaction and duration of admission period so lessening in hospital cost.

4.2.1 Stroke severity: The current study reported that; existence of improvement in stroke severity among study group than control group at third and fourth measurements by proper application of care pathway; this result supported by [21] they documented that; proper identification of stroke severity is an indicator for appropriate planned care by neurologists and neuroscience nurses, wherever they observing and changes in the patient's neurological status and measuring stroke severity for early recovery and improving from stroke. On the other hand the improvement in stroke severity among study group occurred by the effect application clinical pathway which included performing of coma arousal technique; this result supported by [22] and [23] they reported that; proper nursing care and application of coma arousal technique decreased occurrence of physiological parameters adverse events by. The researcher explained that; the stroke severity among study group decreased by application of planned care and closed follow up via clinical pathway team.

4.2.2 Length of hospitalization: The current study reported that; length of hospitalization of study group (intensive care unit and ward) less than control group; this result in the same line with [24] who found that; there was presence of a clinically significant decreasing in the staying length at intensive care unit and length of hospital stays. The researchers explained that; an integrated care by clinical pathway team enhanced the patients' clinical outcomes and minimizing in complications so early discharge.

4.2.3 Concerning post stroke patients' complications: The present study documented that; most of study group free from post stroke complications as urinary tract infection, chest infection and dehydration, only approximately one quarter of control group had urinary tract infection; these results agreed with [18 & 25] who said that; post stroke complications as chest infections and urinary tract infection decreased by the early planned care.

4.3 Regarding to skin integrity & pressure ulcer as a complication post stroke: The current study mentioned that; improvement of skin integrity and decrease degree of pressure ulcer in study group compared to control after intervention. This result supported by [26] who stated that; application of efficient nursing care by guidelines significant for avoiding pressure ulcer in critically ill patients and advance the patient's outcomes. The researchers explained that proper efficient multidisciplinary planned skin care through the clinical pathway application with continue follow up by the team work enhance patient's condition.

4.4 Establishing discharge plan for a safe transfer care from hospital to home: The present study documented that; the study group had planned care from the beginning of patient admission until discharge, before the discharge all patients and their families assessed to determine the need for discuss the preventing measures for stroke recurrence and other post-discharge needs as physical, emotional, recreational, financial and community support with multidisciplinary team to ensure a safe discharge; otherwise the control hadn't the planned care; that result in the same line with [27] reported that; discharge care plan is developed for helping of patients and families and it should be included patient self-management strategies for a safe discharge.

Finally the researchers clarified the important of applied clinical pathway which allow team of work

interact and work efficiently through selected guidelines according patients 'condition,assess and reassess patients to identify progress of patients health status and improve patients 'outcome.

Conclusion

Clinical pathway has a positive effect on reducing length of patient's hospitalization stay, and early improvement in patients' outcomes with apparent positive effect on quality of patient care.

Recommendation: Application of clinical pathway on large samples and variable measurements are in need to generalization of the results. Clinical pathway should be carried out routinely for managing stroke patients in ICU.

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References

1. Abd-Allah F, Moustafa RR. Burden of stroke in Egypt: current status and opportunities. International Journal of Stroke. 2014; 9(8):1105-8.
2. American Heart Association/American Stroke Association: Types of stroke. (2015). Available at http://www.strokeassociation.org/STROKEORG/AboutStroke/TypesofStroke/Types-of-St[Context Link].
3. American Stroke Association. Stroke warning signs. (2015). Available at http://www.strokeassociation.org/STROKEORG/WarningSigns/Stroke-Warning-Signs-and[Context Link].
4. Ojaghihaghighi S, Vahdati S, Mikaeilpour A, Ramouz A. Comparison of neurological clinical manifestation in patients with hemorrhagic and ischemic stroke. World J Emerg Med. 2017; 8(1):34-38.
5. Alrabghi L, Alnemari R, Aloteebi R, Alshammari H, Ayyad M, Al Ibrahim M, et al. Stroke types and Management. Int J Community Med Public Health. 2018 Sep; 5(9):3715. Available at http://www.ijcmph.com.
6. Frank B, Fulton RL, Weimar C, Lees KR. Use of paracetamol in ischaemic stroke patients: evidence from VISTA. Acta Neurol Scand. 2013 Sep;128(3):172-7.
7. Kumar S, Selim M, Caplan l. Medical complications after stroke. Lancet Neurol. 2010 Jan; 9(1):105-18.
8. Luker JA, Wall K, Bernhardt J, Edwards I, Grimmer-Somers K. Measuring the quality of dysphagia management practices following stroke: a systematic review. International Journal of Stroke. 2010 Dec; 5(6):466-76.
9. Sexton A, Chan C, Elliott M, Stuart J, Jayasuriya R, Crookes P. Nursing handovers: do we really need them?. Journal of nursing management. 2016; Jan; 12:37-42.
10. Ahangar A, Saravi M, Alijanpour S, Boora M, Hoseinalipour S, Zadeh, H and Gholinia H. Comparison of Risk Factors of Stroke and Myocardial Infarction in Patients 15 to 45 Years in Affiliated Hospitals of Babol University of Medical Sciences . Zahedan J Res Med Sci. 2016; 18(12):e5332.
11. Huang Z, Dong W, Ji L, Gan C, Lu X, Duan H. Discovery of clinical pathway patterns from event logs using probabilistic topic models. Journal of biomedical informatics. 2014 Feb 1; 47: 39-57.
12. Kebapcı A, Kanan N. Effects of nurse led clinical pathway in coronary artery bypass graft surgery: A quasi experimental study. Journal of Clinical Nursing. 2018 Mar; 27(5-6):980-8.
13. Bin W, Di C, Hongwei Z, Huaxin S, Qi X. Influence of clinical pathways used the hospitals of Traditional Chinese Medicine on patients hospitalized with stroke: a systematic review and Meta-analysis. Journal of Traditional Chinese Medicine. 2017 Apr 1; 37(2):159-64.
14. Tantawi HR, Lotfy I, Abdallh A, Sadek BN. Clinical Pathway versus Traditional Care Plan method for Caring of Postoperative Children Undergoing Cardio thoracic Surgery. Life Science Journal. 2015;12(7).
15. Shahzad MN, Ahmed N. Effectiveness of Aloe vera gel compared with 1% silver sulphadiazine cream as burn wound dressing in second degree burns. J

Pak Med Assoc. 2013 Feb 1;63(2):225-30.

16. Hage V (2011). "The NIH stroke scale: a window into neurological status". Nursing Spectrum. 24 (15): 44–49.
17. George D, Mallery P. SPSS for Windows step by step: A simple guide and reference. 11.0 update. wps. ablongman. com/wps/media/objects/385. George 4answers pdf. 2003;549.
18. Ahangar AA, Saadat P, Alijanpour S, Galeshi M, Hosseinalipour S. Post ischemic stroke complication: How much nursing diagnosis are confirms by neurologist. J Patient Care. 2018; 4(2):1-6
19. Chen R, Ovbiagele B, Feng W. Diabetes and stroke: epidemiology, pathophysiology, pharmaceuticals and outcomes. The American journal of the medical sciences. 2016 Apr 1;351(4):380-6.
20. Huang D, Song X, Tian J, Cui Q, Yang K. Effects of clinical pathways in stroke management: A meta-analysis. Neurology Asia. 2015 Dec 1; 20(4): 335–342.
21. Summers D, Leonard A, Wentworth D, Saver JL, Simpson J, Spilker JA, Hock N, Miller E, Mitchell PH. Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient: a scientific statement from the American Heart Association. Stroke. 2009; 40 (8):2911-44.
22. Mohammed HM, Hassane AE. Nursing Interventions: Effects of Coma Arousal Technique on the Clinical Outcomes of Unconscious Patients. IOSR .2017; 6 (1): 67-80. Available at www. iosrjournals.org.
23. Duwadi S, Budal BS, Hua ZQ. Reducing physical restraint use in critically ill patients. . International Journal of Endorsing Health Science Research. 2018; 6 (1).
24. Joseph J, Gopichandran L, Seth S, Tirwa M. Effectiveness of a structured heart failure clinical pathway on nurses' knowledge and patient care outcomes. J Pract Cardiovasc Sci. 2020;6 (1):53-60.
25. Al-Hashmi A, Al-Saadi A, Maheshwari H, Almamari R, Salunga C, Marfil R. Role of Stroke Unit in Reducing Post Stroke Complications. 2016; EC Neurology 3.4: 412-421.
26. Tayyib N and Coyer F. Effectiveness of Pressure Ulcer Prevention Strategies for Adult Patients in Intensive Care Units: A Systematic Review. Worldviews on Evidence-Based Nursing. 2016; 13(6): 432–444. 2016 Sigma Theta Tau International.
27. Emes M, Smith S, Ward S, Smith A. Improving the patient discharge process: implementing actions derived from a soft systems methodology study. Health Systems. 2019:8(2):117-33.