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Original Article

The Effect of Implementing Ischemic Stroke Nursing Management Protocol on Critical Care Nurses' Knowledge and Practices

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1.ABSTRACT

Background: Stroke is a medical emergency disease that affects millions of people worldwide annually. Early nursing interventions provided during the acute stage of ischemic stroke are essential in increasing survival rates and shaping patients' long-term prognosis. Critical care nurses have a crucial role in providing high-quality care for ischemic stroke patients which can improve their clinical outcomes. Hence, they must have ongoing and periodical training programs about ischemic stroke nursing management. **Aim**: The study aimed to evaluate the effect of implementing the ischemic stroke nursing management protocol on critical care nurses' knowledge and practices. **Method**: A quasi-experimental design was utilized on 56 critical care nurses who were working in the intensive care units affiliated with a University hospital in Egypt. Data were collected by using one tool: Nurses' Knowledge and Practices Regarding Ischemic Stroke Nursing Management Protocol. **Results**: Highly statistically significant differences were found in nurses' knowledge and practices pre and post the implementation of the ischemic stroke nursing management protocol ($P<0.001$). **Conclusion**: The implementation of the ischemic stroke nursing management protocol can improve nurses' knowledge and practices regarding the care of ischemic stroke patients. **Recommendations:** Continuous in-service training programs on ischemic stroke management should be organized for critical care nurses to enhance their knowledge and practices, and keep them up-to-date and competent.

Keywords: Ischemic stroke, Protocol, Critical care nurses, Knowledge, Practice

2.Introduction:

Stroke is the second leading cause of death and the third leading cause of disability worldwide (Katan & Luft, 2018). It occurs due to sudden blood flow cessation to a part of the brain, causing multiple neurological deficits (Kuriakose & Xiao, 2020). Nearly 120 million brain cells die because of stroke, and the brain ages 3.6 years for every hour of blood flow deprivation (Saver, 2006).

According to the global burden of stroke, (2019), the global prevalence of stroke was 101.5 million people; 77.2 million of them were related to ischemic stroke. Furthermore, the World Stroke Organization (2019) reported that 13 million new stroke cases are detected annually. In Egypt, the incidence and prevalence rate of stroke is high. In a systemic review conducted by Abd-Allah et al. (2017) about stroke burden in Egypt, it was reported that the median and mean prevalence rates of stroke were 655/100,000 and 721.6 / 100,000 respectively.

It is estimated that up to 20% of stroke patients need to be admitted to the intensive care unit (ICU) urgently, especially those who need immediate intravenous tissue plasminogen activator or who need urgent endovascular therapy (Amatangelo & Thomas, 2020). Acute stroke patients are susceptible to various neurological, medical, and psychological complications which affect mortality and morbidity in addition to functional disability (Gebremariam & Yang, 2016).

Some of these complications can be prevented through early detection and effective management by well-qualified and skillful nurses (Balami, Chen, Grunwald & Buchan, 2011). Therefore, all aspects of patient care should be time-sensitive and guided by a sense of urgency starting from assessment until evaluation (Samaniego & Hasan, 2019).

Critical care nurses as a part of a multidisciplinary team play a pivotal role in

assessment, identification, monitoring, giving psychological support, as well as implementing rehabilitation plans, and providing end of life care (Stroke Foundation, 2010). Nursing care reflects the incorporation of skills, knowledge, experience, abilities, and attitudes to accomplish the needs of critically ill patients (American Association of Critical Care Nurses [AACN], 2015). Nurses'

knowledge and practice directly affect the quality of nursing care and consequently patient outcomes (Oyira, Ella, Chukwudi & Paulina, 2016).

The World Health Organization (WHO, 2017) recommended that nursing practiceshould be based on the best evidence and recent guidelines. Chang, Sevransky, and Martin (2012) reported that the use of protocols of care can formulate evidence-based nursing guidelines for clinical practice which in turn improves patient outcomes and enhances good prognosis. Organized stroke care using evidence-based protocols has demonstrated a marked reduction in mortality rates, overall stroke complications, and consequently leading to a shorter length of hospital stay (Akhtar et al., 2015). Additionally, following protocols of care can improve patient safety and decrease costs of treatments by reducing inconsistencies in nursing practices (Melgoza, 2017; Tummers, Schrijvers, & Visser-Meily, 2012).

In Egypt, caring for stroke patients is very complex as it is considered the most populated country in the Middle East and the second most populous in Africa. This contributes to the high incidence and mortality of stroke rates among the Egyptian populations (Abd-Allah & Moustafa, 2014). The situation is made worse as the national data about stroke statistics are limited (Abd-Allah et al., 2017).

Some studies reported that most of the Egyptian nurses had insufficient knowledge and practices regarding the management of stroke patients (Khatab, Gomaa & Saaed, 2019;Shehata., Ahmed, Abdelalim & El Sherbiny, 2016; Zidan, Youssef, Abd-Allah & El-Feky, 2018). Stroke training programs were organized for nurses, but they were in the form of establishing standards (Kassem, Weheida, ElSayed, Ewada, & Elkersh, 2010), rehabilitation programs (Abd El-Hay, Abed Allah & Tag Eldein, 2018; Mohsen, El-Mokadem & Abdullah, 2016) or caregiver training programs (Elsheikh et al., 2020). Additionally, studies that addressed these programs were implemented outside critical care settings and covered stroke with its two types; ischemic and hemorrhagic. Moreover, stroke protocols that guide

nurses in ICUs were not available. These issues inspired us to investigate this topic.

Aim of the study

This study aimed to evaluate the effect of ischemic stroke nursing management protocol on critical care nurses' knowledge and practices.

Research hypothesis

To fulfill the aim of this study, we hypothesized that critical care nurses' knowledge and practices will be improved after implementing the designed ischemic stroke nursing management protocol.

3.Method

3.1Research Design

A quasi-experimental one-group (pre/post-test) research design was utilized in this study. It is an empirical design utilized to estimate the causal impact of an intervention on its target population without randomization. It investigates the effect of an independent variable on a dependent variable in a given population (Nestor & Schutt, 2018).

3.2Setting

This study was carried out in four ICUs affiliated with a University hospital in Egypt including Neurological ICU, Stroke ICU, Surgical ICU_1, and Surgical ICU_2. The neurological ICU receives patients with neurological impairments. The stroke ICU is dedicated to providing care for ischemic stroke patients. While the surgical ICU_1 and ICU_2 provide post-operative care for surgical patients and those with neurological impairments. Each unit has a capacity of six beds and is well prepared with advanced equipment, machines, and manpower needed for the care of critically ill patients.

3.3Subjects

The study involved a convenience sample of 56 nurses working in the study setting, who were involved in the delivery of nursing care for ischemic stroke patients, had more than one year ofwork experience in the ICU, and voluntarily agreed to join this research. The nurse patient ratio in theses units was 1:2

3.4Instruments

Data were collected using one tool namely; Nurses' knowledge and practices regarding ischemic stroke nursing management protocol. This tool was developed by the principal investigator (PI) after reviewing the recent relevant literature (Powers et al., 2019; Hackam, & Spence, 2019; Jauch et al., 2013; Saver et al., 2015). It aimed to

assess critical care nurses' knowledge and practices regarding ischemic stroke nursing management protocol. The tool is comprised of three parts as follows:

Part I: Nurses' Demographic Characteristics

This part involved nurses' age, gender, educational level, years of work experience in the ICU, and attended previous training programs and workshops, and⁄or conferences about ischemic stroke patients' management.

Part II: Ischemic Stroke Nursing Management Knowledge Questionnaire

It involved 81 multiple-choice questions covering general information about ischemic stroke, assessment, and general supportive care.

The Scoring system: **The Scoring system**: Each correct answer was given one mark, and the wrong or unknown answer was given a zero. Scores ≥ 80% (65 marks) were considered satisfactory knowledge level. While the scores < 80% (65 marks) were considered unsatisfactory knowledge level. This percentage was decided by a panel of experts, who argued that the lowest acceptable knowledge level for nurses who care for critically ill patients is 80% (Khalil, Esa & Ismaeel, 2020; Zidan et al., 2018).

Part III: Ischemic Stroke Nursing Management Observation Checklist

This part included 71 multiple choice questions addressing assessment and general supportive nursing care for ischemic stroke patients.

The Scoring system: Each item scored based on done correctly = 1, and done incorrectly or not done = 0. The scores ≥ 80% (57 marks) were considered satisfactory practice level, while the scores < 80% (57 marks) were considered unsatisfactory practice level. This percentage was decided by a panel of experts, who argued that the lowest acceptable knowledge level for nurses who care for critically ill patients is 80% (Khalil et al., 2020; Zidan et al., 2018).

3.5Validity and Reliability

The content validity of the tool was assessed by seven experts from the Critical Care Nursing and Medicine fields. Accordingly, essential modifications were made. Part I and part II of the tool were translated into the Arabic language and the back-transition technique was used to ensure the validity of the translation. The reliability of the tool was tested using Cronbach's alpha test and it was 0.93 which indicates a high-reliability tool.

3.6Pilot Study

A pilot study was carried out on 6 nurses to test the applicability, clarity, and feasibility of the data collection tool. This group was excepted from the study sample.

3.7.Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing in a University in Egypt. Permission to conduct the study was guaranteed from the administrative authorities of the selected Hospital. Written informed consent was taken from the participant nurses who agreed to participate in the study after providing them with a comprehensive explanation of the details of the study. All nurses were assured that participation in the study was voluntary and that they could withdraw from the study at any stage without responsibility. Participants' confidentiality and anonymity were assured. Also, the observed practices were not considered a part of their annual performance evaluation.

3.8. Data Collection Process

Data were collected in seven months period between August 2019 and February 2020. Thecurrent study was carried out in four stages:

Stage One: Assessment

Nurses' demographic characteristics were collected by the PI using part I of the tool through interviewing each participant nurse individually for 15 minutes. Then the pretest questionnaire was distributed to them. The questionnaire required between 30-45 minutes to be completed using part II of the tool. The PI collected back the completed questionnaires. Nurses' practices regarding the ischemic stroke nursing management protocol were observed once in one of the three shifts using part III of the tool.

Stage Two: Designing the Protocol

The PI designed the ischemic stroke nursing management protocol based on the most recent evidence-based guidelines (Powers et al., 2019; Bevers & Kimberly, 2017; Feng et al., 2019; Olgers, Dijkstra, Drost-de Klerck & Ter Maaten, 2017). It involved theoretical and practical content. The theoretical part provided an overview of the ischemic stroke while the practical part involved ischemic stroke nursing management in the ICU. It was prepared in the Arabic language as it is the mother tongue of the participants. It was reviewed by a panel of experts in critical care and neurology, and their recommendations were considered.

Stage Three: Implementation Stage

The PI implemented the ischemic stroke nursing management protocol in six teaching sessions in addition to an orientation session for the participant nurses. The nurses were distributed into small groups. Each group involved from 3 to 5 nurses according to their attendance in the shift. Every participant nurse attended six teaching sessions and was given a hard copy of the protocol in the first session for guidance. The PI utilized different teaching methods including lectures, group activities, brainstorming,demonstration, and re-demonstration.

Stage Four: Evaluation Stage

After applying the ischemic stroke nursing management protocol, the PI evaluated nurses' knowledge and practices immediately and two months after implementation.

3.9. Data Analysis

Data entry and analysis were done by using the Statically Package for Social Sciences version 25.0. (Armonk, NY: IBM Corp.). Numbers and percentages were used to express the qualitative data. Mean ± standard deviation (SD) described the quantitative data. The significance level was considered at a p-value $\leq$ 0.05 . Different tests were used to assess the significant differences between the study variables including Pearson Correlation Coefficient(r), Point bi-serial correlation coefficient (rpb), ANOVA test, Spearman's rank-order correlation, Friedman's test, and Paired t-test (t).

4.Results

Table 1 presents the demographic characteristics of participant nurses. It showed that female nurses represented more than three-quarters (78.6%) of the participants. More than half of them (58.93%) were between 20-29 years old. Nearly half of the participant nurses had a Bachelor's degree in nursing with less than five years of work experience in the ICU (55.3% & 51.8% respectively). Furthermore, all participant nurses didn't attend any training program or workshops related to the management of ischemic stroke patients.

Table 2 showed statistically significant differences between nurses' knowledge and practice levels throughout the three study phases **(*P*<0.001)**. The highest total knowledge and total practice levels were noticed immediately after implementing the ischemic stroke nursing management protocol (75% & 83% respectively). However, there was a decline in nurses' knowledge and practice levels after two months (65% & 78% respectively).

Table 3 illustrated statistically significant differences (**P<0.001**) in nurses' knowledge concerning all domains of the ischemic stroke nursing management protocol throughout the three phases of the study. Nurses' knowledge during the immediate phase was better than their knowledge two months after implementation.

Table 4 showed statistically significant differences (**P<0.001**) in nurses' practices concerning all domains of the ischemic stroke nursing management protocol throughout the three phases of the study. Nurses' practices during the immediate phase were better than their practices two months after implementation.

Table 5 showed a statistically significant positive correlation between nurses' total knowledge and total practice scores throughout the three phases of the study.

Table 1Demographic Characteristics of Participant Nurses

Variables	N(56)	%
Gender		
Male	**12**	21.4
Female	**44**	**78.6**
Age 20 - 29 30 - 39 ≥40	 **33** **18** **5**	 **58.93** 32.14 8.93
Mean±SD	28.56±7.12	
Education level Secondary technical school Technical nursing institute Bachelor of nursing	 8 17 31	 14.3 30.4 55.3
Years of work experience in ICU <5 years 5-10 years ≥ 10 years	 29 21 6	 51.8 37.5 10.7
Attended training programs or workshops YesNo	0 56	0 100

Data are expressed as numbers (N) and frequency (%), SD= Standard Deviation

Table 2Nurses' Total Knowledge and Practices Levels Regarding Ischemic Stroke Nursing Management Protocol Throughout the Phases of the Study

Item	Phases of the study						*P* - value
	Before		Immediate		After 2-months		
	≥ 80%	< 80%	≥ 80%	< 80%	≥ 80%	< 80%	
Knowledge	0 (0%)	6 (100%)	42 (75%)	14(25%)	36 (65%)	20 (35%)	**<0.001**
PC	A		B		C		
Practice	0 (0%)	6 (100%)	46 (83%)	10 (17%)	44 (78%)	12 (22%)	**<0.001**
PC	A		B		C		

P-value: Friedman's test, PC: Pairwise comparisons: different letters = Significant difference

Table 3Nurses' Knowledge Regarding Domains of Ischemic Stroke Nursing Management Protocol

	Phases of the study			
Knowledge Domains	**Before**	**Immediate**	**After 2-Months**	***P*- value**
General knowledge	10(17.8%) A	50(89.3 %) B	46 (82.1%) C	<0.001
Assessment	7(12.5%) A	42(75%) B	39(69.6 %) C	<0.001
Airway management	22(39.3%) A	55(98.2%) B	53(94.6%) C	<0.001
Neurological management	4(7. 14 %) A	39(69.6 %) B	36(64.3%) C	<0.001
Hemodynamic management	14(25%) A	40(71.4%) B	38(68%) C	<0.001
rtPA care	8(14.3%) A	51(91 %) B	50(89.3%) C	<0.001
Blood glucose management	18(32.1%) A	50(89.3 %) B	50(89.3%) B	<0.001
Body Temperature management	22(39.3%) A	50(89.3%) B	49(87.5%) C	<0.001
Nutrition management	19(33.9%) A	50(89.3 %) B	49(87.5 %) C	<0.001
Skin care	25(44.6%) A	55(98.2 %) B	53(94.6 %) C	<0.001
Communication	11(19.6 %) A	39(69.6 %) B	36(64.3%) C	<0.001
Bowel & bladder care	20(35.7%) A	50(89.3 %) B	50(89.3 %) B	<0.001
Mobility & activity	16(28.6 %) A	44(78.6%) B	44(78.6%) B	<0.001
DVT prevention	17(30.4%) A	49(87.5%) B	49(87.5 %) B	<0.001

rTPA: recombinant tissue plasminogen activator, DVT: deep vein thrombosis

Table 4Nurses' Practices Regarding Domains of Ischemic Stroke Nursing Management Protocol

	Phases of the study			
Practice Domains	**Before**	**Immediate**	**After 2-Months**	**P-value**
Assessment of stroke	12(21.4%) A	34(60.7%) B	31(55.4 %) C	**<0.001**
Airway management	39(69.6%) A	55(98.2%) B	51(91.1%) C	**<0.001**
Neurological management	3(5.4 %) A	31(55.4 %) B	28(50%) C	**<0.001**
Hemodynamic management	17(30.4%) A	46(82.1%) B	44(78.6%) C	**<0.001**
rtPA care	20(35.7%) A	50(89.3%) B	48(85.6%) C	**<0.001**
Blood glucose management	39(69.6%) A	53(94.6 %) B	52(92.9%) C	**<0.001**
Body Temperature management	37(66.1%) A	54(96.4%) B	50(89.3%) C	**<0.001**
Nutrition management	36(64.3%) A	49(87.5 %) B	45(80.4 %) C	**<0.001**
Skin care	39(69.6%) A	55(98.2 %) B	53(94.6 %) C	**<0.001**
Communication	15(26.8 %) A	42(75 %) B	37(66.1%) C	**<0.001**
Bowel & bladder care	31(55.4%) A	46(82.1 %) B	43(76.8 %) C	**<0.001**
Mobility & activity	23(41.1 %) A	43(76.8%) B	39(69.6%) C	<0.001
DVT prevention	24(42.9%) A	48(85.7%) B	45(80.4 %) C	<0.001

rTPA: recombinant tissue plasminogen activator, DVT: deep vein thrombosis

Table 5Correlation between Participant Nurses' Knowledge and Practice Scores Throughout thePhases of the Study

	Total knowledge scores Mean ± SD	**Total practice scores Mean ± SD**	**rs**	**P-value**
Before	**28.74 ±7.45**	**27.82 ±4.32**	**0.981**	**<0.001**
Immediate	**75.68 ±2.45**	**62.18 ±4.52**	**0.923**	**<0.001**
After 2 onths	**71.89 ±4.45**	**61.22 ±5.95**	**0.762**	**<0.001**

r_s = Spearman's correlation coefficient. P value: Spearman's correlation

5.Discussion

The first hours after a stroke represent a vital step in a patient's care because of the rapid deterioration that may happen to the patient throughout this stage (Catangui, 2019). Early interventions provided during this time are essential in shaping patients' long-term recovery, prognosis, and reduction of mortality and morbidity (Herpich & Rincon, 2020; Morris et al., 2018).

The current study involved a sample of 56 critical care nurses, most of them were females and their ages were between 20-29 years old. This is because nursing is still a female profession in Egypt as males joined the nursing profession recently. Additionally, hospitals tend to appoint newly graduated nurses as critical care nurses in ICUs. These findings are in agreement with the results of other studies (Khatab et al., 2019; Zidan et al., 2018).

The findings illustrated that half of the participant nurses were holding a Bachelor's degree in nursing and had less than five years of work experience in the ICU. This may be attributed to the appointment of Baccalaureate degree nurses as bedside nurses in ICUs to improve the quality of care provided to critically ill patients. Furthermore, nurses who work in ICUs should be skillful and highly competent to deliver the best care for those patients to enhance their recovery and improve their clinical outcomes (Mohamed, Kandeel, Abosaeda & Ali, 2020). This finding is congruent with other studies (Abd El-Hay, et al. 2018; Shehata, et al., 2016).

The current study showed that all participant nurses did not attend any previous training programs or workshops concerning ischemic stroke management. This could be attributed to the unavailability of staff development plans, training resources, and the lack of nursing staff which prevents them to attend training programs. This finding is congruent with the reports of other studies (Eldesouky 2016; Zidan et al. 2018). On the contrary, in Diendéré's (2016) study, about half of the participant nurses reported receiving training about swallowing disturbance among stroke patients. This may be due to organizing continuing education training programs for nurses as a part of the hospital's policy.

Although Powers et al. (2019) emphasized the importance of developing stroke protocols based on recent guidelines, the current study revealed that all nurses had unsatisfactory knowledge and practices concerning ischemic stroke nursing management protocol. This could be due to nurses' workload, inadequate learning resources for nurses, and unavailability of Arabic references about nursing management of ischemic stroke. The unavailability of nursing staff limits the time available for each patient's care and hinders nurses' ability to develop their competencies specific to stroke management. It also prevents nurses to attend training programs or workshops concerning stroke management (Mohamed et al., 2020). These findings are supported by other similar studies which revealed that most participant nurses had insufficient knowledge and practices regarding nursing management of stroke patients (Khattab et al., 2019; Mahdy, Mohammed & Abu Nagm 2016; Yeganeh, Bagheri, Mohammadi, Roshan, & Pouralizadeh, 2019; Zidan et al., 2018). On the contrary, one study conducted in India documented a high mean knowledge score of emergency nurses about tissue plasminogen activator therapy (Baby, Srijithesh, Ashraf & Kannan, 2019) In the same study, most of the nurses were holding a baccalaureate degree and postgraduate studies. This explained the high scores that nurses achieved. Therefore, we implemented educational training for nurses according to the guidelines of the AACN (2015). It recommended organizing continuous education programs for nurses as an attempt to decrease the gap between nurses' knowledge and practices. This will enhance the quality of nursing care and meet the complex needs of stroke patients. Additionally, the WHO (2017) reported that education programs are recognized as an effective method for translating evidence-based into clinical practice.

The current study showed that nurses' knowledge and practices improved after implementing the ischemic stroke nursing management protocol indicating its effectiveness. This is consistent with many research studies which reported that there were statistically significant improvements in nurses' knowledge and practices following stroke management educational program. (Abd El-Hay et al., 2018; Mahdy et a, 2016; McDaniel, 2016; Ram, 2019; Reynolds, Murray, McLennon & Bakas, 2016)

During the acute phase of ischemic stroke, nursing care should focus on the frequent evaluation of the patient's airway, neurological status, and eligibility for rtPA (Summers et al., 2009). The evidence-based recommendations of the American Stroke Association (2015) stated that all ischemic stroke patients should have airway and

breathing support as required. The current study findings pointed out that nurses' knowledge and practice concerning airway management before the implementation of the ischemic stroke nursing management protocol were unsatisfactory. Tan, Sun, and Zhang (2018) found that ineffective airway management practices of neurological nurses contribute to increased aspiration rates, respiratory tract infections, hospital length of stay, costs of treatment, and deterioration in patient's level of consciousness. In the current study, nurses' knowledge and practice concerning airway management improved after implementing the ischemic stroke nursing management protocol. This finding is congruent with Alamri, Waked, Amin, Al-Quliti, and Manzar (2019) who noticed that stroke protocol significantly improved the pulmonary function among stroke patients in the ICU.

Powers et al. (2019) recommended using the National Institute of Health and Stroke Scale for assessing stroke severity. The current study found that there was a statistically significant difference in nurses' knowledge and practices regarding the neurological evaluation of stroke patients. This could be due to nurses' clinical practices before ischemic stroke nursing management protocol implementation was mainly focused on general nursing care for stroke patients regardless of the disease phase (Meng, Chen, & Zhou, 2020). This finding is consistent with Novak (2019) who mentioned that 73.1% of participant nurses were able to apply NIHSS correctly after implementing an education program on NIHSS among staff nurses working in the neurological ICU.

Powers et al. (2019) approved tissue plasminogen activator (rtPA) as the only treatment for ischemic stroke. Our results found that nurses' knowledge and practices regarding care during the administration of rtPA have improved significantly after the ischemic stroke nursing management protocol implementation. This finding goes hand in hand with Z Liu et al. (2018) in Germany who investigated the effect of the quality improvement program on reducing the time to thrombolytic therapy for acute ischemic stroke patients. The researchers detected that median door-to-needle time was shortened from 73 min to 49 min in the post-intervention period.

The findings of the current study exhibited that nurses' knowledge and practice were slightly declined two months after implementing the ischemic stroke nursing management protocol. According to the skill retention theory developed by Kim, Ritter, and Koubek (2013), retention of knowledge is decreased over time. This provides insights for creating continuous refresher training programs to update nurses' knowledge and skills. The same finding was reported in the other two studies (Mahdy et al., 2016; Zidan et al., 2018).

A statistically significant positive strong correlation was detected between the total nurses' knowledge and total practice throughout the study phases. This indicates that nurses' knowledge was transferred to their clinical practice. Similar findings were reported by other investigators (Eldesouky, 2016; Mahdy et al., 2016). However, this finding contradicts the results of Khalil et al., (2020) who noticed a negative correlation between nurses' knowledge and their practice. The authors attributed this to the presence of a knowledge-practice gap.

Overall, the current study findings highlighted the importance of continuing in-service training programs for nurses regarding ischemic stroke nursing management protocol in improving their knowledge and practices. These findings support the researchhypothesis of the study.

6.Limitations

The study was conducted in a small group of critical care nurses in one selected hospital which limits the generalizability of the research findings. Furthermore, there were difficulties to stick with the educational session plan due to participant nurses' heavy work schedule in the selected ICUs

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7.Conclusion *and Recommendations*

The study concludes that the ischemic stroke nursing management protocol is a useful strategy to improve critical care nurses' knowledge and practices. There is a need for periodic appraisal of nurses' practices of ischemic stroke management. Continuous in-service training programs are required for critical care nurses to update their knowledge and practices related to critically ill patients' care.

8.Acknowledgment

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9.Declaration of Conflicting Interests

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

10.References

Abd-Allah, F., Khedr, E., Oraby, M. I., Bedair, A. S., Georgy, S. S., & Moustafa, R. R. (2017). Stroke burden in Egypt: Data from five epidemiological studies. *International Journal of Neuroscience*, *128*(8), 765-771.

DOI: 10.1080/00207454.2017.1420068

Abd-Allah, F., & Moustafa, R. R. (2014). Burden of stroke in Egypt: Current status and opportunities. *International Journal of Stroke*, *9*(8), 1105-1108.

DOI:10.1111%2Fijs.12313

Abd El-Hay, S. A., Abed Allah, A., & Tag El Din, E. (2018). Effect of implementing designed educational training program for neurological nurses on clinical outcomes of stroke patients. *Clinical Nursing Studies*, *6*(4), 121-137.

DOI: 10.5430/cns.v6n4p121

Akhtar, N., Kamran, S., Singh, R., Cameron, P., D'Souza, A., Imam, Y., ... & Shuaib, A. (2015). Beneficial effects of implementing stroke protocols require establishment of a geographically distinct unit. *Stroke*, *46*(12), 3494-3501

DOI: 10.1161/STROKEAHA.115.010552

Alamri, M. S., Waked, I. S., Amin, F. M., Al-Quliti, K. W., & Manzar, M. D. (2019). Effectiveness of an early mobility protocol for stroke patients in intensive care unit. *Neurosciences*, *24*(2), 81-88. Retrieved from: https://www.researchgate.net

Amatangelo, M. P., & Thomas, S. B. (2020). Priority nursing interventions caring for the stroke patient. *Critical Care Nursing Clinics of North America*, *32*(1), 67-84. DOI:10.1016/j.cnc.2019.11.005

American Heart Association/ American Stroke Association (2015). 2015 focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, *46*(10), 3020-3035. Retrieved from: https://www.ahajournals.org/doi/pdf/10.1161/STR.0000000000000074

American Association of Critical-Care Nurses (2015). AACN scope and standards for acute and critical care nursing practice. *American Association of Critical-Care Nurses.* Retrieved from: https://www.aacn.org

Baby, P., Srijithesh, P. R., Ashraf, J., & Kannan, D. (2019). Emergency nurses' knowledge about tissue plasminogen activator therapy and their perception about barriers for thrombolysis in acute stroke care. *International Journal of Non communicable Diseases*, *4*(4), 121-126. DOI: 10.4103/jncd.jncd_16_19

Balami, J. S., Chen, R. L., Grunwald, I. Q., & Buchan, A. M. (2011). Neurological complications of acute ischaemic stroke. *The Lancet Neurology*, *10*(4), 357-371

DOI:10.1016/S1474-4422(10)70313-6

Bevers, M. B., & Kimberly, W. T. (2017). Critical care management of acute ischemic stroke. *Current Treatment Options in Cardiovascular Medicine*, *19*(6), 19-41.

DOI 10.1007/s11936-017-0542-6

Catangui, E. (2019). Improving Glasgow Coma Scale (GCS) competency of nurses in one acute stroke unit-a nursing initiative project. *Journal of Nursing Practice, 3*(1), 109-115. DOI: 10.36959/545/370

Chang, S. Y., Sevransky, J., & Martin, G. S. (2012). Protocols in the management of critical illness. *Critical Care*, *16*(2), 1-6. DOI: 10.1186/cc10578

Diendéré, J., Sawadogo, A., Millogo, A., Ilboudo, A., Napon, C., Méda, N., ... & Desport,

J. C. (2016). Knowledge and practice concerning swallowing disorders in hemiplegic patients among nurses of Bobo–Dioulasso urban primary health care centers in Burkina Faso. *Eneurologicalsci*, 3, 48-53. Retrived from: https://www.sciencedirect.com/science/article/pii/S2405650216300089

Eldesouky, E. I. (2016). Impact of an educational program for nurses' knowledge and practice about Glasgow Coma Scale. *International Journal of Recent Scientific Research, 7*(3), 9690-9695. Retrieved from: http://www.recentscientific.com

Elsheikh, M. A., Moriyama, M., Rahman, M. M., Kako, M., El-Monshed, A. H., Zoromba, M., ... & Amr, M. (2020). Effect of a tailored multidimensional intervention on the care burden among family caregivers of stroke survivors: study protocol for a randomised controlled trial.

Biomedical Journal Open, *10*(12). Retrieved from https://bmjopen.bmj.com/content/10/12/e041637.abstract

Feng, X., Chan, K. L., Lan, L., Abrigo, J., Liu, J., Fang, H., ... & Leung, T. W. (2019). Stroke mechanisms in symptomatic intracranial atherosclerotic disease: Classification and clinical implications. *Stroke, 50*(10), 2692-2699. Retrieved from: https://doi.org/10.1161/STROKEAHA.119.025732

Gebremariam, S. A., & Yang, H. S. (2016). Types, risk profiles, and outcomes of stroke patients in a tertiary teaching hospital in northern Ethiopia. *Neurological Science*, *3*, 41-47 Retrieved from: https://www.sciencedirect.com/science/article/pii/S2405650216300107

Global burden of stroke (2019). The global burden of stroke: Persistent and disabling *The Lancet Neurology*, *18*(5), 417-418.

Retrieved from: https://www.thelancet.com/journals/laneur/article/PIIS1474-4422(19)30030-4/fulltext

Hackam, D. G., & Spence, J. D. (2019). Antiplatelet therapy in ischemic stroke and transient ischemic attack: An overview of major trials and meta-analyses. *Stroke*, *50*(3), 773-778. DOI: 10.1161/STROKEAHA.118.023954

Herpich, F., & Rincon, F. (2020). Management of acute ischemic stroke. *Critical Care Medicine*, *48*(11), 1654-1663. DOI: 10.1097/CCM.0000000000004597

Jauch, E. C., Saver, J. L., Adams Jr, H. P., Bruno, A., Connors, J. J., Demaerschalk, B. M., ... & Yonas, H. (2013). Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, *44*(3), 870-947. DOI 10.1161/STR.0b013e318284056a

Kassem, E.M., Weheida, S.M., ElSayed, S. A., Ewada, S. M., & Elkersh, A. A. (2010). *Establishing standards of nursing care of stroke patient*. (Doctoral thesis, Alexandria University).etrieved from: http://srv4.eulc.edu.eg/eulc_v5/Libraries/Thesis

Katan, M., & Luft, A. (2018). Global burden of stroke. *Seminars in Neurology*

38(2), 208-211. DOI: 10.5167/uzh-159894

Khalil, N., Esa,R. & Ismaeel,M. (2020): Critical care nurses' knowledge and practices regarding dysphagia care of acute ischemic stroke patient. *World Journal of Pharmaceutical and Medical Research* 6(3), 12-18

Retrieved from: https://www.wjpmr.com

Khatab, R., Gomaa, N., & Saaed, A. (2019). Factors affecting nursing performance in caring patients with cerebral stroke during first golden hours. *Evidence-Based Nursing Research*, *1*(1), 1-10. Retrieved from: https://www.noveltyjournals.com

Kim, J. W., Ritter, F. E., & Koubek, R. J. (2013). An integrated theory for improved skill acquisition and retention in the three stages of learning. *Theoretical Issues in Ergonomics Science*, *14*(1), 22-37 Retrieved from: https://doi.org/10.1080/1464536X.2011.573008

Kuriakose, D., & Xiao, Z. (2020). Pathophysiology and treatment of stroke: present status and future perspectives. *International Journal of Molecular Sciences*, *21*(20), 1-24. DOI: 10.3390/ijms21207609

Liu, Z., Zhao, Y., Liu, D., Guo, Z. N., Jin, H., Sun, X., ... & Yan, X. (2018). Effects of nursing quality improvement on thrombolytic therapy for acute ischemic stroke.*Frontiers in Neurology*, *9*, 1-7. DOI: 10.3389/fneur.2018.01025

Mahdy, N. E., Mohamed, Y. M., & Nagm, L. M. A. (2016). Positioning and early mobilization: Effect of educational guidelines on nurses' performance and stroke patients' outcome. *Journal of American Science*, *12*(8), 131-146. Retrieved from: http://www.jofamericanscience.org/

McDaniel, J. T. (2016). Improving nurses' knowledge of stroke. (Doctoral thesis, Walden University). Retrieved from: https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=3600&context=dissertations

Melgoza, Y. (2017). *Improving stroke documentation on a stroke unit*. (Master thesis, University of San Francisco). Retrieved from:

https://repository.usfca.edu/cgi/viewcontent.cgi?article=1564&context=capstone

Meng, X., Chen, X., Liu, Z., & Zhou, L. (2020). Nursing practice in stroke rehabilitation: Perspectives from multi-disciplinary healthcare professionals. *Nursing & Health Sciences*, *22*(1), 28-37. Retrieved from: https://doi.org/10.1111/nhs.12641

Mohamed, A. M., Kandeel, N. A., Abosaeda, A. I., & Ali, W. G. M. (2020). Effect of educational sessions about early mobilization of critically ill patients on nurses' knowledge and practices. *Journal of Nursing and Health Science*, *9*(5), 1-9. DOI: 10.9790/1959-0905040109

Mohsen, M. M., El-Mokadem, N. M., & Abdullah, S. E. (2016). Effectiveness of physical rehabilitation on clinical outcomes of patients following stroke. *Egyptian Nursing Journal*, *13*(3), 200-210. DOI: 10.4103/2090-6021.200182

Morris, S., Ramsay, A. I., Boaden, R. J., Hunter, R. M., McKevitt, C., Paley, L., ... & Fulop, N. J. (2018). Impact and sustainability of centralizing acute stroke services in English metropolitan areas: retrospective analysis of hospital episode statistics and stroke national audit data. *Biomedical Journal*, *364*. 1-11

Retrievedfrom: https://www.bmj.com/content/364/bmj.l1.full

Nestor, P. G., & Schutt, R. K. (2018). *Research methods in psychology: Investigating human behavior*. (3rd). United States of America: Sage Publications

Novak, A. (2019). *The effect of a simulation-based education program on NIHSS accuracy and inter-rater reliability among nursing staff in the neurological/neurosurgical intensive care unit*. (Master thesis, University of Kentucky).

Olgers, T. J., Dijkstra, R. S., Drost-de Klerck, A. M., & Ter Maaten, J. C. (2017). The ABCDE primary assessment in the emergency department in medically ill patients: an observational pilot study. *Netherlend Journal of Medicine*, *75*(3), 106-11. Retrieved from: http://www.njmonline.nl/cntpdf.php?t=i&id=204#page=12

Oyira, E. J., Ella, R. E., Chukwudi, U. E., & Paulina, A. I. (2016). Knowledge practice and outcome of quality nursing care among nurses in university of calabar teaching hospital (UCTH). *Journal of Education and Training Studies*, *4*(11), 179-193 Retrieved from: https://files.eric.ed.gov/fulltext/EJ1117617.pdf

Powers, W. J., Rabinstein, A. A., Ackerson, T., Adeoye, O. M., Bambakidis, N. C., Becker, K., ... & American Heart Association Stroke Council. (2019). Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, *50*(12), 344-418. DOI:10.1161/STR.0000000000000211

Ram, G. N. (2019). Effectiveness of supplementary training on knowledge and attitude regarding comprehensive care of acute ischemic patient among nursing staff. *International Journal of Health Sciences and Research*, *9*(12), 90-96.

Retrieved from: http: //www.ijhsr.org

Reynolds, S. S., Murray, L. L., McLennon, S. M., & Bakas, T. (2016). Implementation ofa stroke competency program to improve nurses' knowledge of and adherence to stroke guidelines. *Journal of Neuroscience Nursing*, *48*(6), 328-335

DOI: 10.1097/JNN.0000000000000237

Samaniego, E. A., & Hasan, D. (Eds.). (2019). *Acute Stroke Management in the Era of Thrombectomy*. United States of America: Springer. P 5-19

Saver, J. L., Goyal, M., Bonafe, A., Diener, H. C., Levy, E. I., Pereira, V. M., ... &. Jahan. R., (2015). Solitaire™ with the Intention for thrombectomy as primary endovascular treatment for acute ischemic stroke trial: protocol for a randomized, controlled, multicenter study comparing the Solitaire revascularization device with IV tPA with IV tPA alone in acute ischemic stroke. *International Journal of Stroke*, 10(3), 439-448. DOI: 10.1111%2Fijs.1245

Saver, J. L. (2006). Time is brain—quantified. *Stroke*, *37*(1), 263-266

DOI: 10.1161/01.STR.0000196957.55928.ab

Shehata, H. S., Ahmed, S. M., Abdelalim, A. M., & El Sherbiny, N. (2016). Knowledge and attitude towards stroke among workers in Cairo University Hospitals. *The Egyptian Journal of Neurology, Psychiatry and Neurosurgery*, *53*(1), 54-59DOI: 10.4103/1110-1083.176374

Summers, D., Leonard, A., Wentworth, D., Saver, J. L., Simpson, J., Spilker, J. A., ... & Mitchell, P. H. (2009). Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient: a scientific statement from the American Heart Association. *Stroke*, *40*(8), 2911-2944. Retrieved from: https://doi.org/10.1161/STROKEAHA.109.192362

Stroke Foundation (2010). Clinical guidelines for stroke management a quick guide fornursing. Retrieved from: www.strokefoundation.com.au.

Tan, Y., Fe, S., & Zhang, S. (2018). Application of details management in airway management of patients in the neurological intensive care unit. *International Journal of Clinical Medicine*, *11*(5), 5079-5086. Retrieved from: http://www.ijcem.com/

Tummers, J. F., Schrijvers, A. J., & Visser-Meily, J. M. (2012). Economic evidence on integrated care for stroke patients; a systematic review. *International Journal of Integrated Care*, *12*. Retrieved from: http://www.ijic.org

World Health Organization. (2017). Facilitating evidence-based practice in nursing in the WHO European Region. Retrieved from: https://www.euro.who.int/

World stroke organization (2019): Global stroke fact sheet 2019.

DOI: 10.1177%2F1747493019881353

Yeganeh, M. R., Bagheri, Z. F., Mohammadi, T. K., Roshan, Z. A., & Pouralizadeh, M. (2019). The knowledge of nurses about evidence-based guideline in patients with acute ischemic stroke. *Journal of Pharmaceutical Research International,* 1-10. Retrieved from: https://doi.org/10.9734/jpri/2019/v27i130160

Zidan, S., Youssef, W., Abd-Allah, F. O. A. D., & El-Feky, H. A. (2018).Impact of a designed acute stroke nursing management protocol on nurse's knowledge and practice. *Impact Journal* (49) 23-39.

Retrieved from:https://www. impactjournals.