

Bite-Sized Teaching Sessions Effects on Emergency Nurses' Knowledge and Practice Regarding Traumatic Brain Injury

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Abstract: Traumatic brain injury (TBI) is the major leading cause of disability, death, and health-related expenditures. The first target of nursing management in traumatic brain injury is to sustain adequate brain tissue perfusion. **Aim:** This study aimed to assess the effectiveness of bite-sized teaching sessions about traumatic brain injury on nurses' knowledge and practice. **Setting:** The study was conducted within the Emergency Department at Suez Canal University out for this study (pre/post & follow-up test). An appropriate sample of 70 nurses introduces the nursing care for a patient with TBI in the setting was mentioned above, from Sep. 2019 to Jun. 2020. Two tools were used for the gathering data. First tool: A structured interviewing questionnaire sheet consisted of seven sections to assess the nurses' knowledge and the second tool: An observational checklist to assess the nurses' practice for the Glasgow coma scale. **Results:** Findings of the current study indicate statistical significance difference between pre, post, and follow-up tests regarding nurses' knowledge and care practices for patients with traumatic brain injury at a 1% level of statistical significance. **Conclusion:** Implementation of bite-sized teaching session's strategies improved nurses' knowledge and practice while managing patients with a traumatic head injury. **Recommendation:** Continuous bite-sized teaching sessions should be scheduled regularly for the emergency nurses about traumatic brain injury to reinforce patient's quality of care and improving patient outcome.

Keywords: Bite-sized Teaching Sessions., Traumatic head injury., Nurses., Knowledge., practice.

1. INTRODUCTION

Traumatic brain injury (TBI) is disruption of brain cellular function through direct, rotational, and shear forces caused mainly due to external mechanical forces to the skull [1]. TBI is divided into primary and secondary brain injury. The Primary brain injury caused by mechanical damage of trauma [2] causes direct tissue damage and disturbed auto regulation of cerebral blood flow lead to ischemia consequence with accumulation of lactic acid, augmented cell membrane permeability and subsequent brain edema [2], [3]. It followed by a secondary brain insult that developed after the primary insult within hours or days due to the release of excessive excitatory neurotransmitters such as glutamate and aspartate which activate the apoptotic cascade and ultimately lead to membrane degradation and neural cell damage and death [1], [3], [4].

TBI usually presents with a combination of medical, sensory, physical, cognitive, behavioral, communication and social problems. Disturbed perception is the hallmark symptoms of a traumatic head injury that may lead to problems with memory, attention, learning and coordination [5]. Cognitive aspects such as memory loss, slow reaction in addition to the

psychological disorders like depression and anxiety [6]. Symptoms such as dizziness and headache are most commonly reported, sequenced with nausea and neck pain [7].

Survival after a TBI depends on immediate emergency assessment and the focused intervention of primary and secondary injuries [8]. Initial assessment and intervention for TBI patients should be according to the advanced trauma life support algorithm. Early neurological assessment and initiation of emergency care for TBI patient are vital measures to prevent mortality. The neurological assessment should focus on the degree of Glasgow Coma Scale (GCS), pupil size, reflexes, and focal neuroscience [8]. Therefore, nursing management in emergency room begins with the identification of TBI, assessment of patients' level of consciousness using GCS, airway and C-spine protection, oxygenation and ventilation, disability and intracranial pressure management [10].

GCS is one of the most effective and widespread scoring techniques for assessing the patient's level of consciousness [11], in order to establish a baseline from which improvement or deterioration can be assessed [12]. The primary goal of using GCS is to recognize those who need emergency intervention as early as possible and prevent secondary brain injury, thus decreasing mortality and morbidity [13]. The GCS is based on the sum of several categories extending from 3 to 15 according to the response to verbal, eye opening, and general motor stimuli calculated from the observed spontaneous actions and the use of verbal and / or painful stimuli [14]. A GCS score of 13–15 indicates mild brain injury and the majority of patients recover within 10 - 14 days [15]. A score of 9 -12 point to moderate brain injury and patient with score 8 or less indicates severe brain injury [16], which indicates ensure adequate oxygenation, monitoring blood pressure (systolic BP >90 mmHg), peripheral cannulation, and cardiac monitoring in addition to pulse oximetry [17] [18].

Furthermore, one of the main goals of nursing intervention for the patient with TBI is to preserve the adequate cerebral tissue perfusion [17]. Nursing management focus on enhancing ICP stability, reducing intracranial pressure (ICP) elevations, ensuring adequate cerebral perfusion pressure (CPP), avoiding hypotension and hypoxia, and rehabilitative treatment to improve patient outcomes as well as better survival rates [18], [19] and provide patient and family education in order to reassure them for better outcomes [20]

Availability of the nursing staff for teaching and training can be challenging specially in hot areas as Emergency Units. One of the emerging strategies for health professions development and education, often known as bite-sized or micro learning, utilizes brief, concentrated learning units, which frequently used interchangeably, it employs brief learning units built around a specific objective. Bite-sized teaching (BST) is an instructional approach that incorporates bite-sized learning principles and peer teaching purposefully sessions aims to enhance learning by targeting extraneous load to facilitate working memory, offer an opportunity for staff to revitalize their information and pinpoint their own learning needs in a timely and cost-effective method [21]. BST involves the delivery of high-impact, 10-minute lessons in any topics related to physical health, which conducted one time per week in the unit lunchtime or handover period. It is creative, easy to implement, and has ascertained transferable across different ward-based settings [23], [24].

Bite-sized teaching (BST) flexible, and teachers are expected to respond to the demands of each ward. Potential advantages of BST for health professions education involve its ability to contend with cognitive load and ability to use this approach in concert other instructional strategies. Early reports suggest this approach is feasible and viewed positively by learners in postgraduate and undergraduate medical education [12, 13]. To date, literature is largely limited to descriptive report with limited exposure and outcomes reported [9–13]. Evidence of the impact of bite-sized learning on learners and learning in medical education is lacking.

In order to simplify organization, and delivery, BST does not use instructional presentation software or require any other equipment, and the main delivery method is intended to be discussion based on prompts and mentions from the individual A4 handout. The additional benefits of the BST are that it strengthens departmental work relationships and allows training of clinicians to gain significant educational experience [23] and its ability to contend with cognitive load and ability to use this approach in concert other instructional strategies [24]

Significant of the Study

TBI is a silent epidemic which causes death and disability worldwide [25]. 10 million people succumb to traumatic brain injuries worldwide as a result of car accident [26]. According to the WHO, 2018 road traffic deaths in Africa are highest at 26.6 deaths per 100,000 population [27]. Trauma considered as the sixth leading cause of death worldwide and deaths

represents 8% of all deaths in Egypt [28]. TBI accounts for 40% of all injuries deaths which affecting all ages and results in a combined physical, cognitive, and behavioral impairment resulting in a decreased quality of life among patients and relatives [29], [30]. It is the main cause of death and disability among young people and about half of trauma deaths are in persons aged between 15 and 45 years [28], [31].

The global rise of a head injuries rate and consequently its burden sharply increased mainly due to the increased use of cars in low-income countries and middle-income countries [32]–[35]. Regrettably, Egypt ranks first in the world in road accidents, as about 12,000 Egyptians died in a traffic collision at a rate of 60 victims per day, based on the latest statistics made by the Central Agency for Mobilization and Statistics [36], [37]. The World Health Organization prophesies a remarkable increase in the TBI burden in the next decades, with increased incidence in low- and middle-income countries three times more than TBI cases than high-income countries [38]. TBI was predicted to become the third cause of disease morbidity by 2020 [39]. The burden is specifically raised among teenagers and young adults, thereby, severe individual and family interruption and life-long disability resulted [38].

The emergency nurses are responsible for continues monitoring and maintaining physiological parameters associated with TBI. Therefore, nurses as members of the healthcare team are best at detecting and preventing secondary head injury [40], [41]. However, nurses differ in their practices, and few is known about how nurses manage a secondary head injury. The evidence-based guidelines have been developed for the care of patients with TBI, but the extent to which these guidelines influence nursing practice in the secondary head injury management was not clarified [8], [42]. Thereby, our goal of the present was to assess the effectiveness of TBI bite-sized teaching sessions on emergency nurses' knowledge and practice.

Operational definitions

- **Bite-sized Teaching:** (BST) is an instructional approach that involve bite-sized learning principles and peer teaching. It's a brief, focused learning units built around a specific objective. The result is swapping a 40 to 50- min teaching session with 4 to 5 brief (10 min) teaching micro-sessions created and delivered by researchers.
- **Traumatic brain injury:** It is an injury that interrupts normal brain function due to application of external mechanical forces to the skull.
- **Nurses:** Licensed health care professionals whom practice work independently or under the supervision to promote and maintain the health of the patient.
- **Knowledge:** It refers to the acquaintance with or understanding of the sciences, art regarding traumatic head injury.
- **Practice:** It is the ability to using the knowledge effectively and easily in performance.

2. SUBJECT AND METHODS

Aim of the study:

The aim of this study was to assess the effectiveness of TBI bite-sized teaching sessions on emergency nurses' knowledge and practice.

Research hypothesis: The following research hypothesis were formulated to fulfill the aim of this study:

Hypothesis 1: Emergency Care Unit Nurses will have better knowledge and practice after implementation the BST sessions.

Hypothesis 2: Positive correlation will be found between implementation of BST sessions and nurses' knowledge and practice.

Research Design:

The research method adopted for this study was a Quasi-experimental design (pre- post and follow up test) to accomplish the aim of the current study.

Setting:

The current study was conducted in the Emergency Department at one of the university hospitals, Ismailia, Egypt.

Sampling

In the current study a convenience sample was used to include all nurses (70) providing direct nursing care to the patient with TBI in the above mention setting.

The tool of data collection

Two tools were used for data collection:

Tool one: Structured interviews questionnaire. Adopted from Mohammad [43] and modified by researchers after reviewing the related literature. It was written in simple Arabic, and was used to assess the nurse's knowledge, and it consisted of seven parts:

Part one: Social and demographic characteristics of the sample studied, such as the age of nurses, educational level, years of experience and previous training.

Part two: Questions regarding the anatomy and functions of the head. This part was consisted of 7 multiple choice questions (parts of the brain controls personality, emotions, behavior, the basic life function, the visual therapy, understanding, cognition, and the storing memories in the brain).

Part three: Questions regarding the traumatic head injury. This part was consisted of 5 multiple choice questions (the causes of head injury, the diagnosis, the clinical manifestations, the treatment, and the complications).

Part four: Questions regarding the intracranial pressure. This part was consisted of 7 multiple choice questions (the normal range, the causes, the content, the clinical manifestations, diagnosis, treatment and complications).

Part five: Questions regarding the GCS. This part consisted of 9 multiple choice questions (Function of GCS, components of GCS, eye-response, verbal response, motor response, the worst result, the best result, the degree of coma, and the documentation).

Part six: Questions regarding the principals of nursing management of head trauma. This part was consisted of 8 multiple choice questions (The tracheal suctioning, the oxygen therapy, the monitoring of SaO₂, arterial puncture, the cardiac monitoring, measurement of CVP, the deep vein thrombosis prophylaxis, and the neurological management).

Part seven: Questions regarding the basic care of a head injury. This part consists of 6 multiple-choice questions (side effects of increased metabolic rate, patient feeding, change of patient position, nursing intervention for ear bleeding, nursing intervention to patient's eyes and contraindications of restrain). For each portion, the item scores were summarized. These scores have been converted into a percentage. Overall scores of 75% and over were considered satisfactory in knowledge while scores below 75% were unsatisfactory.

Scoring system of the knowledge: The total nurses' knowledge score against the seven core items, nurses were awarded 1 point for each correct answer and zero for incorrect answers.

Tool two: An observational checklist based on a GCS to assess nurse's practice regarding GCS responses adopted from Mehta and Chinthapalli [44] involved eye, motor and verbal. The eye-opening includes 4 elements, the verbal response contains 5 elements, and the motor response includes 6 elements. The numeric values from 1-4 in the eye-opening, 1-5 in the verbal response, and 1-6 in the motor response. In each part, the highest numeric value indicates the best response, while the lowest values indicate a poor response. The sum of these numeric values indicates the level of consciousness.

Scoring system: A total of nurses' practice scores against three core items, the nurses were given 1 point for each competent practice and 0 for the incompetent practice. For each portion, the item scores were summarized. These scores have been converted into a percentage. Ineffective practice: <85% of all practice scores and competent practice scores: ≥ 85% of total practice scores.

Ethical considerations: Approved consent obtained from Faculty of nursing ethical committee in Port Said University. Officials' approval was obtained to collect data after clarifying the purpose of the study and the intervention that could contribute to expand the nurse's knowledge and practice about traumatic brain injury. In the initial interview, the researchers introduced themselves to the nurses and explained the purpose of the study. Every nurse was informed of the right to refuse or participate in the study with anonymity and the confidentiality of the information collected was

guaranteed. Finally, the nurse's formal consent to participate was obtained and reassured that they had the right to withdraw from the study without any penalty.

Validity and Reliability of the Tool

The validity test was performed by five experts in Medical-Surgical and Critical Care Nursing and 2 consultant Neurology. The reliability of the nurse's knowledge questionnaire sheet was confirmed by Cronbach's alpha coefficient (alpha =0.85 for the Nurses' Knowledge Questionnaire and Alpha = 0.92 for the Nurse Performance Sheets)

Pilot study: A pilot study was performed on 7 nurses (10% of the studied sample) in order to test the clarity and applicability of the tools as well as to evaluate the average time required to fill out the questionnaire. No changes were made to the study tools, so 10% of the study sample was involved in this study.

Procedure for data collection

Fieldwork: Data collection was conducted from Sep. 2019 to Jun. 2020.

Assessment phase

An official permission was granted from the appropriate authoritative personnel. Potential nurses who agree to participate in the study were interviewed individually according to the available time. The researchers introduced their selves to the nurses and clarified the purpose of the study. The nurses were invited to fill out the questionnaire (tool1) and it took 15 minutes (pretest). Nurses' practices were observed by the researchers using tool 2 observational checklist during actual clinical care practice as well as nurses' notes were revised in that shift in order to pick up any nursing interventions that was done for the patients regarding assessing level of consciousness. Nurses were not informed that they were observed. Nurses' performance was observed three days per week during the morning and afternoon shifts. The assessment phase took 3 months to complete the required data. Areas of weaknesses in nurses' knowledge and practices were identified and program objectives.

Implementation phase

The bite-sized teaching sessions was developed based on the identified nurses' needs collected in the preprogram phase. The sessions included information related to anatomy and physiology of the head, traumatic brain injury, intracranial pressure, GCS, principals of nursing management and basic care. Practical session includes Glasgow coma scale (eye-opening response, verbal response and motor response). Pre session assessment and post session feedback were applied each session. The program planned for twelve sessions per six weeks (10-12 min. for explain and 3- 5 for summarizing the contents), eight sessions for knowledge and four for practical part included demonstration and re-demonstration of the related skills. Each session included one group of the studied nurses; each group contained ten nurses. During these sessions, the researchers teach contents in a clear, simple language using lectures, illustrative pictures, displayed simple training videos for practical skills related to GCS. At the end of each session researchers review on tips the contents of the session and summarized of the main points. Each nurse received the contents at the end of each session by handouts and all session's contents were collected in a booklet including theoretical and practical session and provided to all participants.

Evaluation phase

Nurses' knowledge and practices about TBI were reassessed using Tool I and II immediately after implementation of the knowledge related and skills related session and it took four months (post-test). Reassessment for retention was carried out three months later (follow-up test).

Data processing and analysis: Data were analyzed using the IBM Statistical Package of Social Science (SPSS) version 20. Descriptive statistics containing frequency distribution, percentage, means, and standard deviations were utilized, while t-test and Chi square as inferential statistics were utilized to compare results pre and post intervention. Level of significance was adopted at $p < 0.05$, while highly significant level was set at $p < 0.001$.

3. RESULTS

Table 1: Demographic Characteristics of the Studied Nurses (No=70)

Demographic characteristics		No.	Percentage %
Age	20 - < 30 years	25	35.7%
	30 - < 40 years	33	47.1%
	40 - < years	12	17.2%
	Mean ± SD 23.1±10.40		
Education Level	Technical nursing institute	65	92.8%
	Bachelor degree	5	7.2%
Years of experience	1 - < 5 years	18	25.7%
	5 - <10 years	28	40%
	10 - < 15 years	10	14.3%
	15 - < 20 years	14	20%
Previous training about traumatic head injury	Yes	0	0.0%
	No	70	100%

Table 1: Describes the distribution of the studied nurses in relation to their demographic characteristics, it was found that the mean ± SD was 23.3 ± 10.40 and 47.1% of the age of the studied nurses was between 30 - <40 years while 35.7% of them were between 20 <30 years. Year. The majority of the studied sample was (92.8%) graduates of the Technical Nursing Institute.

Table (2): Differences in the total Mean ± S.D of nurses' knowledge regarding traumatic brain injury Throughout the Study Phases (n=70).

Knowledge	Pre	Post	Follow up	F. test	P. value
	Mean±S.D	Mean±S.D	Mean±S.D		
Anatomy and physiology of head (7Q)	3.75±2.38	6.50±0.64	6.2±0.45	7.05	0.001**
Traumatic brain injury (5 Q)	3.90±1.30	4.85±0.53	4.3±0.44	4.28	0.001**
Intracranial pressure (7Q)	3.03±0.80	5.60±0.63	5.1±0.51	15.97	0.001**
Glasgow coma scale (GCS). (9 Q)	3.43±2.49	7.40±0.71	6.9±0.46	23.3	0.001**
Principals of nursing management (8Q)	5.38±2.49	8.30±1.11	7.9±1.3	6.78	0.001**
Basic care (5 Q)	5.65±0.74	7.55±0.68	7.2±0.58	12.02	0.001**

NB: ** P<.001

P1: between pre, post-test and follow up test

Table 2: Showed the differences in the total mean ± S.D of nurses' knowledge regarding traumatic brain injury on pre, post, and follow-up tests, it was clarified that total Mean ± S.D of knowledge increased on the post and follow up test than on pre-test. Therefore, there was a highly statistically significant difference between nurses' knowledge on pre and post-test at a 1% level of statistical significance.

Table (3) Comparison of Nurses' Knowledge Regarding Principles of Nursing Management for TBI throughout the Study Phases (n=70)

Items		Pre		Post		Follow up		X ²	P value
		No	%	No	%	No	%		
Tracheal suctioning	Correct	70	100%	70	100%	70	100%	-	-
	Incorrect	0	0.0%	0	0.0%	0	0%		
Oxygen therapy	Correct	65	92.8%	68	97.2%	68	97.2%	F. Test 1.053	0.305
	Incorrect	5	7.2%	2	2.8%	2	2.8%		

Sao ₂ monitoring	Correct	70	100%	70	100%	70	100%	-	-
	Incorrect	0	0.0%	0	0.0%	0	0%		
Arterial puncture	Correct	47	67.1%	70	100%	67	95.7%	F. Test	0.000
	Incorrect	23	32.9%	0	0.0%	3	4.3%	15.522	
Cardiac monitoring	Correct	63	90.0%	63	90.0%	63	90%	F. Test	1.000
	Incorrect	7	10.0%	7	10.0%	7	10%	0.000	
CVP measurement	Correct	65	92.8%	66	94.2%	66	94.2%	F. Test	0.644
	Incorrect	5	7.2%	4	5.8%	4	5.8%	0.213	
DVT prophylaxis	Correct	9	12.8%	57	81.4%	54	77.1%	F. Test	0.000
	Incorrect	61	87.2%	13	18.6%	16	22.9%	39.298	
Neurological management	Correct	7	10.0%	63	90.0%	56	80%	F. Test	0.000
	Incorrect	63	90.0%	7	10.0%	14	20%	51.20	

NB: ** $P < .001$ ns means not significant * $P < .05$ P1: between pre and post -test FT: Fisher's Exact Test Satisfactory level of nurse's knowledge = score of 75% and more.

Table 3: Reflected the comparison of nurses' knowledge related to principles of nursing management for TBI in pre, post, and follow-up test. It was revealed that all of the subjected nurses (100%) had correct knowledge regarding tracheal aspiration and SaO₂ monitoring and the majority of them had a satisfactory level of knowledge about oxygen therapy, heart monitoring and CVP measurement (92.8%, 90%, 92.8%)% respectively. Whereas. there was an unsatisfactory level of knowledge about DVT prevention and neurological management (12.8% and 10.0%, respectively) on initial testing and improved after educational program delivery.

Table (4): Nurses' Knowledge Related to Basic Care of TBI throughout the Study Phases (n=70)

Items		Pre		Post		X ²	NP value
		No	%	No	%		
Side effects of Increased metabolic rate	Correct	12	17.1%	63	90.0%	F. Test	0.000
	Incorrect	58	82.9%	7	10.0%	42.288	
Patient feeding	Correct	61	87.2%	67	95.7%	F. Test	0.235
	Incorrect	9	12.8%	3	4.3%	1.409	
Changing of position	Correct	56	80%	70	100%	F. Test	0.003
	Incorrect	14	20%	0	0%	8.889	
Nursing intervention for ear bleeding	Correct	9	12.8%	63	90%	F. Test	0.000
	Incorrect	61	87.2%	7	10%	48.080	
Nursing intervention to patient's eyes	Correct	4	5.8%	59	84.3%	F. Test	0.000
	Incorrect	66	94.2%	11	15.7%	51.717	
Contraindication of restrain	Correct	70	100%	70	100%	-	-
	Incorrect	0	0%	0	0%		

NB: ns means not significant * $P < .05$ P1: between pre and post- test FT: Fisher's Exact Test

Satisfactory level of nurse's knowledge = score of 75% and more.

Table 4: Represented the nurses' knowledge related to the basic care of traumatic brain injury on pre, post and follow-up tests, it was clarified that on pre-test, it was demonstrated that in pretesting, all of the nurses subjected to the study (100%) had valid knowledge about the restraints contraindications. Also, the majority of the nurses had a satisfactory level of knowledge about patient feeding and changing positions (87.2% and 80%, respectively). Although there was a lack of knowledge about the side effects of increased metabolic rate, nursing intervention for ear bleeding, and nursing eye care of the patient (17.1%, 12.8%, 5.8% respectively) in the initial test. The results showed that the nurse's knowledge was greatly improved on the post-test. Therefore, highly statistically significant differences founded between the knowledge of the nurses at a 1% level of statistical significance.

Figure (1): The Total Mean Scores of Nurses' Practices Regarding the Glasgow Coma Scale Throughout the Study Period.

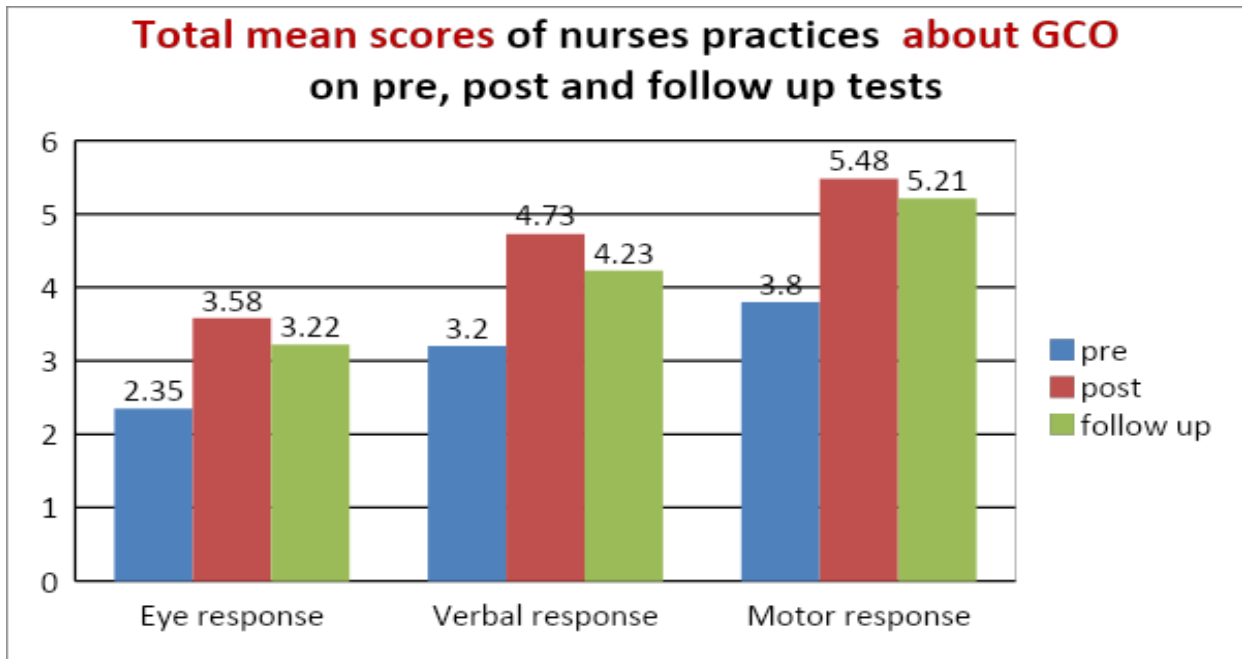


Figure 1: Illustrated the total Mean scores of nurses' practices regarding the (GCS). At pre- post and follow up tests, it was represented that there was marked increase in practice level in the post-intervention then slightly decrease after three months in all items.

4. DISCUSSION

TBI is a leading cause of disability and death worldwide. Nurses monitor all consequences of TBI and have the practices that can improve the patient's recovery. It is crucial for nurses to have a care protocol involving clear knowledge and practices to help them achieve the greatest possible outcomes and provide high quality care to the patients with TBI [45].

Concerning demographical characteristic of studied sample, it was illustrated that mean age was twenty-three years. While, the mean age found by Mahday et al [46] was thirty-two years and Oyesanya [47] who found the mean age of studied nurses was 40.3 years. This could show that the majority of nurses had limited experience especially in management of patients with TBI. So, enhancing nurse's level of knowledge through in-service education was promptly needed. Moreover, the study showed that more about one third of studied nurses aged less than thirty years and less than half had have less than forty years. This was similar to Abd El Moteleb [48] who reported that more than two third of nurses was about thirty years and Shehab et al [33] found that more than two third of nurses had less than three years. This may illustrate needs for frequent in-services training sessions to enhance nurses' knowledge and performance to promote patient safety and improve quality of life.

Regarding educational level, it was clarified that the majority of studied nurses had graduated from technical nursing institute and bachelor degree. Such finding was in agreement with [43] who reported that half of studied nurses had have a technical nursing education. In this respect, Eldesouky [49] reported that less that less than two third of studied nurses were graduated from secondary nursing school and more than one third of them graduated from technical nursing institute. This was contradicted with Oyesanya et al [50] who found few number of diploma nurses and bachelors' were more than two third, while masters or doctorate holders represent sixteen percent. Present study results reversed with Seliman et al [8] who reported that few of the study subjects were technical nursing institute, while the majority of them have diploma degree. This could show that enhancing nurse's level of education through in-service education was promptly needed.

Concerning nurses' years of experience, it was showed that about two third of studied nurses had less than ten years of experience. In this respect, Elsayed and Mohammad [43] mentioned that about two third of studied nurses had less than ten years of experience. This demonstrates needs for update and improvement of knowledge and performance regarding traumatic brain injury. According to previous training in traumatic brain injury, it was clarified that none of nurses had previous training in traumatic brain injury care. This was consistent with Shehab et al [51] who reported that all of studied nurses had no training and also there is no protocol of care and Refaey [52] reported that most of studied nurses had not received training. Moreover, Oyesanya [53] who reported that only few of critical care nurses received training as part of their education. Otherwise, Ayoub et.al [54] found that more than half of the studied nurses received training on GCS and neurological assessment for head trauma patients and Abed et al [55] found the majority of emergency nurses received training in trauma care.

Post BST sessions implementation, the nurse's knowledge had improved tremendously with highly statistical significant differences between nurses' knowledge at 1% level of statistical significance which reflect the positive effectiveness of the BST sessions which come in line with [21] who use the BST for teaching postgraduate medical student and suggest that brief teaching units have a significantly better effect on immediate knowledge recall than case-based teaching and Sunley et al [56] who applied the BST session in the pediatric emergency unit and conclude positive improvement in nurses knowledge. Moreover, same results by [61]–[65] as the all applied a traditional teaching sessions and concluded significant improvement in the nurses' knowledge after educational intervention. Hence, first research hypothesis was empirically tested and confirmed.

Furthermore, the findings represented in the current study were consistent with [8], [55], [62], [63] who reported that there was improvement in the total score of knowledge post educational program implementation. In this regard, Ghoneim et al [64] mentioned that implementation of nursing care protocol on moderate head injured patient had best effect on reduce the incidence of all systemic complications, decrease morbidity and mortality rate. Moreover, this finding was justified by Abdelmowla et al [65] who reported that enhancement of nurses' knowledge is a consequence of implementing a training program.

The result of the present study showed decrement in nurses' knowledge score over time after three months of educational session's implementation which could be attributed to knowledge decay. Similarly, Mansour [55], and Shahin [62] found a decline with limited value in nurse's knowledge level after three months of program implantation compared to immediate posttest. In this context, Park et al. [67] clarified that post education knowledge level of subjects significantly improved right after intervention, but effects significantly decreased or disappeared as time passed and the participants are to revert to their pre-education baseline. Thereby, refresher program, continuous feedback after education, and follow-up are necessary to update the nurses' knowledge and improve quality of care.

Current study findings also represented comparison between nurses' knowledge about principals of nursing management of TBI on pre, post and follow-up tests. It was revealed that all studied nurses had correct knowledge regarding tracheal suctioning and SaO₂ monitoring and the majority had satisfactory level of knowledge about oxygen therapy, cardiac monitoring and CVP measurement. This indicates that the higher level of education is associated with higher knowledge score and higher competence in the application of procedures.

The present study revealed that there was unsatisfactory level of knowledge about DVT prophylaxis and neurological management in the assessment phase. This demonstrates need for training session to enhance nurse's knowledge and to clarify the role of the nurses in caring for patient with TBI and decrease the risk for DVT development. This was corresponding with Zhou et al., [68], [69] who found that emergency nurses had inadequate knowledge and awareness of the intervention of VT and Moreover, Oyesanya et al [53] mentioned that more education and training is required for nurses to guarantee they have accurate TBI care information nurses' roles clarification

Concerning nurses' knowledge about basic care of TBI on pre, post and follow-up tests, it was clarified that on pre-test, all studied nurses had correct knowledge about contraindication of restraints. Also, the majority of nurses had satisfactory level of knowledge about feeding and changing position. This may be associated with more work experience had effect on their knowledge. Although, there were unsatisfactory level of knowledge about side effect of increase metabolic rate,

nursing care when ear bleed and nursing care to patient' eyes. Perhaps, this can be attributed to lack of in-service education. Therefore, there is a need for continuous BST sessions to update nurse's knowledge. This was corresponding with Tume [70] who mentioned that it is important for nurses working with patient with traumatic brain injuries to understand the neuro-pathophysiology of TBI and the evidence for nursing interventions used in the ICU.

In respect to nurses' practice in this study, the most prominent improvements were in the scores of practice about GCS and principals of nursing care as the nurses were had insufficient level in the pre BST sessions phase with significantly improved in immediate post- sessions then slightly decreased in the follow up test which comes in line with Reith et al [71] who reported that majority of nurses showed good knowledge and practice about GCS after program implementation and Ayoub el al [54] who found that about half of the critical care nurses have inadequate level of knowledge about GCS and recommend the importance of continuing education and practice on the use of the GCS tool.

In addition, our finding represented comparison between nurses' practice regarding GCS in pre, post and follow-up tests, it was represented that the majority of studied nurses had incompetent practice < 85% on pre-test. This was consistent with Thi and Chae [72] who concluded that the nurses were lacking practices about GCS especially when it comes to the clinical setting. As well as, Fischerand and Mathieson [73] reported an inconsistency in the use of GCS in the clinical setting. This may be due to lack of training programs therefore education and training is required to ensure patient outcomes and quality of care.

In post BST implementation, all nurses had competent practice regarding GCS > 85% of total practice score. Therefore, there were highly statistical significant differences between practices of nurses at 1% level of statistical significance. This is supported by the findings of other similar study conducted with Eldesouky [49] who reported that there are statistically significant improvements immediately after program implementation of GCS. This is comparable with Shahin et al [74] and [43] who stated that there was a highly statistical significant improvement in participants' scores of practice in pre-program and post program following the instructional program.

Also, it was found that statistically significant relation between nurses' knowledge and practice regarding to GCS. Thereby, improvements of specific knowledge related to TBI are associated with achievement of best practice and increase precision in the use of scale. Therefore, there were highly statistical significant differences between practices of nurses at 1% level of statistical significance. This agree with [8] who stated that a highly statistical significant correlation between participants' scores of practice in pre-program, post program, 1 month and 2 months following the instructional program. In the present study, the most prominent improvements of mean practice score about motor response (5.48 ± 0.91). Therefore, there were highly statistical significant differences between nurses' practice at 1% level of statistical significance. While, Mohammad [43] concluded that majority of studied subjects had satisfactory level of knowledge at both immediate post interventions and follow up phases (91.1% and 84.4% respectively).

This result agreed with Abd el-Aziz [75] who concluded that the education program leads to significant improvement in nurse's skills. This finding was congruent with Taha [75] who reports an improvement after implementation of the program with a highly significant statistical difference. These agree with Shahin et al [74] who stated that a highly statistical significant correlation between participants' scores of knowledge in pre-program and post program following the instructional program. This improvement reverved to quality of the educational nursing strategies. On follow-up tests, it was noticed from the results of the present study that there was a reduction in total practice scores obtained after three months in some items than on immediate post-test. In this respect, Mansour [66] emphasized that the result of his study reported a decline with limited value after 2 months' period, then immediately after the program implementation. This could reflect that nurses need for a series of continuing training program and adequate follow-ups to adapt to new knowledge and practices.

5. CONCLUSION

In the light of the present study, it was concluded that knowledge and skills had a positive effect in improving nurses' knowledge and practice regarding head injury in Emergency Department. After providing TBI bite-sized teaching sessions as evident from the obtained data $P < 0.001$.

6. RECOMMENDATIONS

Based on the results of this study the following recommendations are suggested:

- The study recommended continuous bite-sized teaching sessions should be planned on regular basis to nurses' caring of TBI patients for enhancing the nurses' knowledge and practice to achieve high quality of care.
- Endorse the educational program for TBI care in the orientation program for nurses.
- Continues in service education regarding TBI care is required.
- Replicate the study on a larger probability sample in different settings for generalizing the results.

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