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Effect of Clinical Nursing Guidelines for Traumatic Brain Injuries on Secondary Brain Injury and Mortality

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Abstract

Severe traumatic brain injury is a major worldwide critical health and socioeconomic problem. Clinical nursing guidelines at emergency setting is a crucial treatment in Preventing mortality and secondary brain injury by avoidance of systemic physiological disturbances. The aim of the current study was to examine the effect of clinical nursing guidelines for traumatic brain injuries on selected patients' Secondary Brain Injury and Mortality**.** The 40 adult male and female patients (20 for each study and control groups) were recruited within a quasi- experimental research design. Personal background and medical data sheet for severe traumatic brain injured patients and Secondary brain injury assessment sheet for severe traumatic brain injured patients were used to examine the selected outcomes. Patients were assessed once admitted to the emergency department till transfer to ICU or operating room. Hypothesis one was supported as there were significant statistical differences between the studied groups as regards to signs of secondary brain injury (heart rate (p: 0.007), respiratory rate (p: 0.02), paco2 (p: 0.0001), Oxygen saturation (p: 0.0001), blood glucose level (p: 0.005), PH(p: 0.0001), and convulsion (p: 0.05) after implementing clinical nursing guidelines for the study group, However, the other hypothesis can't be supported as there were no significant statistical differences regarding frequency of mortality, although there was one case (5%) of the control group died in comparison to no deaths occurred in study group. Applying adapted clinical nursing guidelines in management of patients with severe traumatic brain injuries can improve patient outcomes by preventing secondary brain injury and reducing frequency of mortality in the emergency department. Implementation of adapted clinical nursing guidelines in the management of patients with severe traumatic brain injuries in emergency setting.

Keywords: Severe traumatic brain injury, clinical nursing guidelines, mortality, secondary brain injury

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1. Introduction

Traumatic brain injury (TBI) is a leading cause of death and disability [1,2]. it was specified as a main healthcare problem that annually affects 10 million people worldwide, predominately men. Even in (advanced) high-income countries, the trend of TBI incidence is rising and corresponds to a silent epidemic [3]. In Egypt, the trauma burden is viewed as a hidden epidemic. The widely (and probably growing) problem of traumatic injury is underreported because there is inadequate national data and improper documentation. This has a negative effect on the quality of care provided to trauma patients[4]. TBI mainly affects young guys with road traffic accidents, and 20.3% of them typically suffer from severe brain injuries [5]. As a result, recognizing the characteristics of patients with head injuries is crucial [6].

According to the Centers for Disease Control and Prevention (2021), traumatic brain injury is defined as "disruption in the normal function of the brain that can be caused by a bump, blow, or jolt to the head, or a penetrating head injury". The severe type of traumatic brain injury is most often quantified as an initial Glasgow Coma score of ≤ 8 [8]. It can impair a person's cognitive, physical, or emotional functioning that may last for years or be lifelong[9]. This cognitive, mental, and physical impairment in survivors after TBI may result in a major burden for families and societies [10].

In general, primary tissue disruption that occurs at the time of injury is irreversible [11]. Secondary insults that worsen the severity of the injury occur throughout the hours and days that follow, but they may be treatable [12]. Increased intracranial pressure (ICP), hypoxia, systemic hypotension, and brain herniation are the causes of these secondary insults by which outcomes for the affected patients may be significantly impacted [13]. Therefore, the goal of the current clinical TBI management is to reduce secondary insults [14].

The treatment of severe TBI is complex, and challenging and often necessitates a multimodal, standardized approach. This approach generally includes circumspective hemodynamic monitoring and support, fluid and electrolyte management, respiratory therapy and other

aspects of care that focus on preventing secondary brain injury, maintaining adequate cerebral perfusion pressure and improving cerebral oxygenation. It also requires collaboration across multiple disciplines, including the involvement of critical care nurses, neurosurgeons, neuro-intensivists, respiratory therapists and other health care specialties [15].

Nurses are the medical personnel who witness the full impact of TBI and possess the expertise to change the course of a patient's cure [16]. As the only health care professionals by the bedside around the clock, nurses have a crucial part in the early neuroprotective nursing care for moderate or severe TBI patients. The initial nurses' role in management of those patients is multifaceted, for instance, monitoring of patient's ventilation and oxygenation, cerebral perfusion pressure (CPP), intracranial pressure (ICP), and neurological examination, and how nurses carry out these duties affects patient mortality and outcomes[17]. Therefore, it is crucial for nurses to have a valuable resource with evidence-based nursing practices to assist them in achieving the best possible outcomes [16].

Evidence-based practice guidelines are growingly being promoted in all branches of medicine [18]. These clinical practice guidelines are mostly created and disseminated by well-known organizations to enhance quality of care, reduce discrepancy in practice, and guarantee that evidence is followed [19]. Adherence to clinical practice guidelines for traumatic brain injury are more likely to decrease mortality, maximize clinical outcomes, and create substantial economic savings by lowering costs of medical care, rehabilitation, and lost productivity [20]. Therefore, the aim of the current study was to examine the effect of clinical nursing guidelines for traumatic brain injuries on selected patients' Secondary Brain Injury and Mortality. To achieve the aim of the study the following research hypotheses were formulated: (a) Patients with severe traumatic brain injuries who will be exposed to the adapted clinical nursing guidelines will show lesser signs of secondary brain injuries than those who will not be exposed as indicated by improved oxygenation, hemodynamic parameters, acid base and neurological status. (b) Patients with severe traumatic brain injuries who will be exposed to the adapted clinical nursing guidelines will have lesser frequency of mortality than those who will not be exposed.

2. Methods

2.1. Research design

A quasi experimental (control and study groups) research design was utilized in this study. A quasi-experiment is a research design that resembles an experiment in structure, but the conditions and experiences of participants lack some control because the study lacks randomization. In study and control groups quasi-experimental research design the independent variable are changed in the study group and kept constant in the control group. Then the results of these groups are compared.

2.2. Setting and samples

The study was carried out at an emergency department affiliated to Cairo University Hospitals, where patients with severe traumatic brain injuries can be allocated. The emergency department is located in the ground floor of the Cairo university hospital. It consists of: trauma and accident resuscitation room, surgical and renal resuscitation room, ophthalmology room, ENT room, laboratory and radiology rooms for CT scanning and plan x-ray and ultrasonography imaging. These rooms are equipped with equipment, supplies, and advanced technology required for different emergency services. The accident resuscitation room in which the study conducted can receive 10 patients at admission who need resuscitation and continuous monitoring.

Forty adult male and female patients with severe traumatic brain injuries with the following inclusion and exclusion criteria; Inclusion criteria: patients who are more than 18 years with Glasgow Coma Score less than 9 and attended to the emergency department during golden hour (the first two hours after trauma). While the exclusion criteria were; patients with delayed disposition due to no vacancy, more than 2 hours' time spent before admission to emergency, major chest, abdominal trauma, multiple fractures (pelvis, femur) as confirmed by radiological examination or with history of brain diseases (tumors or old cerebral stroke, etc.)

2.3. Intervention

The applied adapted clinical nursing guidelines were adapted from The Brain Trauma Foundation guidelines and an evidence-based care bundle for management of severe traumatic brain injuries done by Damkliang et al. (2014). They include a series of nursing actions and Strategies for Preventing secondary brain injuries and reducing frequency of mortality of patients suffering severe traumatic brain injuries and were applied in the emergency department immediately after receiving severe traumatic brain injured patients. They include securing airway along with c-spine protection, ensuring adequate oxygenation and ventilation, maintaining circulation, fluid and acid-base balance, managing the patient's pain, agitation, and irritability through following the prescribed medication order from emergency physician, follow up and monitoring of patients' condition till disposition from emergency to ICU or OR.

2.4. Measurement and data collection

Two tools were utilized to collect data pertinent to the current study. These two tools were constructed by the researcher and reviewed by a panel of three experts in the field of nursing (critical care nursing) and three experts in critical care medicine. These tools are as follow: (i) Personal background and medical data sheet for severe traumatic brain injured patients (Tool 1): It includes data related to age, gender, medical diagnosis, mechanism of injury, pre arrival management, clinical presentation, way of patient transport, time left before admission, Glasgow Coma Scale (scored 3-15), Revised Trauma Score (scored 0-12), past medical history, other extra cranial injuries, allergy, last meal, medication, history of vomiting, history of convulsion, pupil assessment, hemodynamic, vital signs assessment, connection, fluid replacement, labs, diagnostic procedures and patient response to treatment (survived or died). (ii) Secondary brain injury assessment sheet for severe traumatic brain injured patients (Tool 2): It includes data related to signs of secondary brain injury such as bradycardia, hypotension, hyper/hypothermia, hypoxemia, hypoxia,

hypo/hypercapnia, hyper/hypoglycemia, Acid-base disorders and seizure.

Content validity was done to identify the degree to which the used tools measure what was supposed to be measured. Tools were examined by a panel of five critical care nursing and medical experts to determine whether the included items were clear and suitable to achieve the aim of the current study. Regarding reliability of the data collection tools, the pilot study conducted before data collection revealed no modifications to study tools, then the internal consistency of the tools was measured by using Cronbach's alpha test and it was 0.75 which is accepted.

In the initial recruitment phase of data collection, the eligible subjects were selected according to inclusion and exclusion criteria, the purpose and nature of the study were explained to the participants' relatives and a verbal then written informed consent from the selected participants' relatives were obtained after patient's resuscitation. Regarding implementation phase, after initial resuscitation for the traumatic non-responsive patients with GCS less than 9 whom attended during the golden hours (first two hours after trauma), the investigator screened all patients admitted to the emergency department for their eligibility to the study. Then the allocation of the patients was done by using every other patient (the first admission met inclusion and exclusion criteria included in the control group and the next one in the study group) with consideration for matching between the studied groups. Both control and study groups received the routine hospital care, beside the study group received also the adapted clinical nursing guidelines over 60 to 90 minutes for the aim of preventing secondary brain injuries and mortality of patients suffering severe traumatic brain injuries. These adapted guidelines focus on securing airway along with c-spine protection, ensuring adequate oxygenation and ventilation, maintaining circulation, fluid and acid base balance, managing the patient's pain, agitation, and irritability through following the prescribed medication order from emergency physician, follow up and monitoring of patients' condition till disposition from emergency to ICU or OR (around 4.5 hours mean period before disposition).Also, in this phase, the patients' demographic and health-relevant data were collected using tool I.

In the evaluation phase, survival (Tool I) and secondary brain injury (Tool II) for both study and control groups were monitored and evaluated during presence in emergency department and immediately before transfer to intensive care unit or operating room.

2.5. Data analysis

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

Findings of this study were limited to a small sample size because of limited patient's numbers fulfilling inclusion and exclusion criteria as the total study subjects. Therefore, it may not be necessarily representative for the general population of patients suffering severe traumatic brain injuries. In addition, the study was affected by the COVID-19 Pandemic. Finally, the study is confined to one geographical area at Cairo which limited the study generalization.

2.6. Ethical considerations

Primary approval was obtained from the ethics committee at the Faculty of Nursing - Cairo University. A final approval was obtained after finishing data collection according to the institutional Review board for the protection of human rights with reference number IORG 0006883-IRB 2019041701-FWA 00026458. Also an official permission was obtained from hospital administrators to conduct the study. Participation in the study was entirely voluntary; each subject had the right to withdraw from the study when he or she wants. Informed consent obtained from the subjects. Anonymity and confidentiality were assured through coding the data, also, subjects were assured that this data will be used in the purpose for the research only.

3. Results

3.1. Finding related to background and medical data

The current study showed that, the numbers of subjects in both control and study groups were equal (20 patients in each group). The personal background was similar in both two groups. The majority (80%) of the control and study groups were male. Concerning age, it showed that more than one third of the control and study groups were under 30 years old, with mean age (42.2±19.2) versus (42.25±18.5) respectively. Accordingly, there were no significant statistical differences among the studied groups regarding age and gender table (1).

Regarding clinical presentation, table (2) revealed that, the mean GCS of the control and study group was(6.90± 1.37),and (7.50± 1.15) respectively. The majority (90%) and (95%) of both control and study groups attended with scalp wound and fractures, with no signs of basal skull fracture (rhino/otorrhea) (90%) and (80%) respectively. Concerning presence of extracranial injuries, table (2) showed that more than half (55%) of the control group had extracranial injuries versus two-third (70%) in the study group. However, there were no significant statistical differences among the studied groups regarding clinical presentation items and extracranial injuries.

The study findings showed that, around one-third (30%) and (35%) of the control and study groups were diagnosed as SDH and near two- third (60%) and (65%) of both groups' mechanism of injury was Motor car accident respectively.

Table 1: Percentage Distribution of the study Subjects as Regards to age and gender (n=40).

Personal background		Study group(n=20)		Controlgroup(n=20)		Chi-square	p-value
		No.	%	No.	%		
Age	less than 30	7	35.0	7	35.0	0.25	0.99
	30-39	3	15.0	3	15.0		
	40-49	2	10.0	2	10.0		
	50-59	3	15.0	4	20.0		
	60 +	5	25.0	4	20.0		
	Mean± Sd	42.25±18.5		42.2±19.2			
Gender	Male	16	80.0	16	80.0	0.00	0.99
	female	4	20.0	4	20.0		

Significance level **: p < 0.01

Table 2: Percentage Distribution of the study Subjects as Regards to clinical presentation/extra cranial injuries (n=40).

Clinical presentation/extra cranial injuries		Study group (n=20)		Control group (n=20)		Chi-square	p-value %
		No.	%	No.	%		
Conscious level	Mean ± Sd	7.50 ± 1.15		6.90 ± 1.37		8.1	0.14
Scalp wound/ fracture	No	1	5.0	2	10.0	0.36	0.54
	yes	19	95.0	18	90.0		
Bleed nose or ear	No	17	85.0	17	85.0	0.00	0.99
	yes	3	15.0	3	15.0		
Rhino/otorrhea	No	17	85.0	18	90.0	0.22	0.63
	yes	3	15.0	2	10.0		
Extra cranial injury	No	6	30.0	9	45.0	0.96	0.32
	yes	14	70.0	11	55.0		

Significance level **: p < 0.01

Table 3: Percentage Distribution of the study Subjects as Regards to medical diagnosis /mechanism of injuries (n=40).

Medical diagnosis/Mechanism of injury		Study group(n=20)		Control group(n=20)		Chi-square	p-value %
		No.	%	No.	%		
Medical diagnosis	SDH	7	35.0	6	30.0	0.44	0.97
	ICH	5	25.0	4	20.0		
	DAI	1	5.0	1	5.0		
	EDH+SDH	3	15.0	4	20.0		
	SAH+SDH	4	20.0	5	25.0		
Mechanism of injury	MCA	13	65.0	12	60.0		
	FALL	5	25.0	6	30.0	0.13	0.93
	Blunt	2	10.0	2	10.0		
History:Convulsion	No	20	100.0	20	100.0	0.0	0.99
History:Vomiting	No	20	100.0	20	100.0	0.0	0.99

Significance level **: p < 0.01

Table 4: Percentage Distribution of the study Subjects as Regards to Pre-arrival management/ time consumed before admission to emergency room (ER) (n=40).

Pre arrival management/time before admission to emergency Room		**Study group (n=20)**		**Control group(n=20)**		**Chi-square**	**p-value**
		No.	%	No.	%		
Pre arrival management	No	19	95.0	19	95.0	0.00	0.99
	yes	1	5.0	1	5.0		
Transport (ambulance)	No	5	25.0	5	25.0	0.00	0.99
	yes	15	75.0	15	75.0		
Time consumed before admission to ER	<1 hour	11	55.0	10	50.0	0.1	0.75
	>1 hour	9	45.0	10	50.0		

Significance level **: p < 0.01

Table 5: Percentage Distribution of the study Subjects as Regards to pupil assessment (n=40).

Pupil Assessment		Study group(n=20)		Control group(n=20)		Chi-square	p-value
		No.	%	No.	%		
Pupil at Admission	Normal	9	45	7	35	0.63	0.72
	Unequal size / sluggish	10	50	11	55		
	Dilated / sluggish	1	5	2	10		
Pupil assessment before transfer to ICU or operating room	Normal	9	45	4	20	7.6	0.05*
	unequal size / sluggish	9	45	7	35		
	dilated equal / sluggish	1	5	1	5.		
	dilated unequal / sluggish	1	5	7	35		
	fixed dilated	0	0	1	5		

Significance level **: p < 0.01

Table 6: Percentage Distribution of the study Subjects as Regards to transfer outcomes (n=40).

Transfer Outcomes		Study group(n=20)		Control group(n=20)		Chi-square	p-value
		No.	%	No.	%		
Transfer to	ICU	13	65.0	11	55.0	1.0	0.59
	OR	7	35.0	8	40.0		
	discharge (die)	0	0.0	1	5.0		
Time left till transfer	3	1	5.0	1	5.0	5.3	0.61
	4	10	50.0	10	50.0		
	5	6	30.0	8	40.0		
	6	2	10.0	0	0.0		
	7	1	5.0	1	5.0		
	Mean± Sd	4.6 ± .94032		4.5 ± .82717			

Significance level **: p < 0.01

Table 7: Percentage Distribution of the study Subjects as Regards to response to treatment (n=40).

Response to Treatment	Study group(n=20)		Control group(n=20)		Chi-square No.	p-value %
	No.	%	No.	%		
Survived	20	100.0	19	95.0	1.0	0.31
Died	0	0.0	1	5.0		

Significance level **: p < 0.01

Table 8: Percentage Distribution of the study Subjects as Regards to secondary brain injury (n=40).

Signs of Secondary Brain Injury		Study group(n=20)				Control group(n=20)				Chi-square		p-value	
		Baseline		Follow up		Baseline		Follow up		Base-line	Follow up	Baseline	Follow up
		No.	%	No.	%	No.	%	No.	%				
Temperature	Normal	17	85.0	16	80.0	19	95.0	11	55.0	4.1	3.7	0.12	0.15
	High	0	0.0	0	0.0	1	5.0	2	10.0				
	Low	3	15.0	4	20.0	0	0.0	7	35.0				
	Normal	9	45.0	12	60.0	14	70.0	3	15.0	3.6	10.0	0.15	0.007*
	High	9	45.0	5	25.0	6	30.0	6	30.0				
	Low	2	10.0	3	15.0	0	0.0	11	55.0				
	Normal	16	80.0	17	85.0	20	100.0	11	55.0	4.4	4.3	0.1	0.11
	High	1	5.0	2	10.0	0	0.0	7	35.0				
	Low	3	15.0	1	5.0	0	0.0	2	10.0				
	Normal	4	20.0	15	75.0	5	25.0	7	35.0	0.4	7.8	0.8	0.02*
	High	4	20.0	4	20.0	5	25.0	6	30.0				
	Low	12	60.0	1	5.0	10	50.0	7	35.0				
	Normal	4	20.0	14	70.0	6	30.0	2	10.0	0.94	15.4	0.62	0.0001*
	High	12	60.0	5	25.0	9	45.0	12	60.0				
	Low	4	20.0	1	5.0	5	25.0	6	30.0				
	Normal	0	0.0	15	75.0	0	0.0	2	10.0	0.0	17.2	0.99	0.0001*
	Low	20	100.0	5	25.0	20	100.0	18	90.0				
	Normal	15	75.0	17	85.0	9	45.0	7	35.0	3.7	10.7	0.053	0.005*
	High	5	25.0	3	15.0	11	55.0	11	55.0				
	Low	0	0.0	0	0.0	0	0.0	2	10.0				
	Normal	5	25.0	15	75.0	6	30.0	2	10.0	0.4	17.7	0.81	0.0001*
	Resp. Acidosis	11	55.0	2	10.0	9	45.0	8	40.0				
	Resp. Alkalosis	4	20.0	1	5.0	5	25.0	6	30.0				
	Mixed Acidosis	0	0.0	2	10.0	0	0.0	4	20.0				
	No	20	100.0	18	90.0	20	100.0	13	65.0	0.0	3.5	0.99	0.05*
	Yes	0	0.0	2	10.0	0	0.0	7	35.0				

Table 9: Comparison between study and control groups means as regards to secondary brain injury (n=40)

Parameters	Study		Control		Difference	
	Mean	Sd	Mean	Sd	t	P
Temperature (baseline)	36.68	0.36	36.80	0.39	1.059	.296
Temperature (follow up)	36.67	0.38	36.62	0.57	0.293	.771
HR (baseline)	93.05	28.31	93.35	24.70	0.032	.972
HR (follow up)	88.15	25.16	82.85	33.29	0.568	.573
BP (baseline)	106.50	20.14	114.25	17.57	1.297	.202
BP (follow up)	121.75	23.07	126.95	32.26	0.587	.561
RR (baseline)	13.95	9.01	15.45	10.29	0.491	.627
RR (follow up)	16.80	5.05	15.75	8.24	0.486	.630
Co2 (baseline)	42.80	7.27	41.50	7.94	0.539	.593
Co2 (follow up)	41.90	5.59	42.05	9.22	0.063	.951
O2 (baseline)	85.20	7.30	79.55	6.58	2.572	.014*
O2 (follow up)	95.05	3.28	90.05	4.84	3.823	.0001*
BGL (baseline)	112.60	30.19	134.95	41.74	1.940	.060
Blood glucose level (follow-up)	113.65	42.89	148.80	64.66	2.026	.049*
PH (baseline)	7.37	0.07	7.39	0.07	0.873	.388
PH (follow up)	7.38	0.05	7.38	0.09	0.324	.747

*Significant at p-value<0.05

Also, all (100%) of the studied sample had no recent history of convulsion or vomiting before arrival at the emergency room. So, there were no significant statistical differences among the studied groups regarding medical diagnosis, mechanism of injury, and history of vomiting and convulsion table (3). Table (4) also concluded that almost all of the studied sample (95%) didn't receive pre-arrival management. Concerning the transfer method, three-quarters of the both control and study groups (75%) attended to the emergency by ambulance, and around half (50%) and (55%) of them spent less than 1 hour before arrival to emergency room respectively. Accordingly, there were no significant statistical differences among the studied groups regarding pre-arrival management, way of transport, and time spent before emergency arrival.

Regarding pupil assessment, it was cleared that, around two-thirds (65%) and more than half (55%)of the control and study groups had abnormal pupil size and reaction (unequal size/sluggish pupil reaction or dilated)with no significant statistical differences at the first time assessment, while the majority (80%) and more than half (55%) of them had abnormal size and reaction at the transfer time to ICU or operating room respectively, with a significant statistical differences between the studied groups and this results indirectly support hypothesis (1) table (5). In addition, more than half (55%) of the control group was transferred to ICU, while around two thirds (65%) of the study group were transferred to ICU and half (50%) of both groups were transferred within 4 hours from emergency admission with mean 4.5 ± .82717 and 4.6 ± .94032 respectively table (6).

3.2. Finding related to testing the research hypothesis

As regards to frequency of mortality, Table (7) showed that, the majority (95%) of patients in the control group survived while one (5%) was died, versus all of patients in the study group were survived, with no significant statistical differences between control and study groups in reducing frequency of mortality and this result does not support the hypothesis (2). Also table (8) highlighted that, there were no significant statistical differences between the studied groups in relation to signs of secondary brain injury at baseline time (at time of arrival to emergency room), while there were significant statistical differences between them at follow up time (after interventions). P-value by chi-square estimation (nonparametric statistics) was 0.007, 0.02, 0.0001, 0.0001, 0.005, 0.0001, and 0.05 for heart rate, respiratory rate, paco2, oxygen saturation, blood glucose level, arterial blood gases, and convulsion respectively. As regards heart

rate, the majority (80%) of the study group had normal heart rate, while more than half (55%) of the control group had bradycardia. Also, three quarters (75%) and more than one third (35%) had normal respiratory rate and the majority (70%) had normal Paco2, while more than half (60%) had hypercapnia among the study and control groups respectively.

Regarding Oxygen saturation, the majority (75%) had normal oxygen saturation and (90%) had hypoxemia and the majority (85%) had normal blood glucose level and more than half (55%) had hyperglycemia among study and control groups respectively. Also, the majority (75%) had normal PH, while near half (40%) had respiratory acidosis and the majority (90%) and around two thirds (65%) had no convulsion among the study and control groups respectively. This results support hypothesis (1) table (8). Table (9) revealed that there was a significant statistical difference between means of oxygen saturation in study and control groups at baseline time (at time of arrival to emergency room) and at follow up time (after interventions) as p value by compare means estimation (parametric statistics) was 0.014 and 0.0001 and respectively. also, blood glucose level showed significant statistical difference at follow up time (p value 0.049).

4. Discussion

The present study delineated that, the majority of the studied cases were male and more than one third of the study sample's age was under 30 years old and the mean age of the control group was 42.2±19.2 versus 42.25±18.5 in the study group. In accordance with these results, Mohamed et al, (2018) in a study titled "The effectiveness of clinical pathway-directed care on hospitalization-related outcomes in patients with severe traumatic brain injury: A quasi-experimental study" reported that the study sample overall was predominantly young and male [15]. Also, data from Salama, Maray & Hamed (2015) indicated that, the young adult group in the third decade of life was the most age group affected (71%) and mean age of 38 years [21].

Moreover, English et al, (2013) Reported that Men represented 64 % of the patients with severe traumatic brain injuries [22]. Also, Samanamalee et al, (2018) reported that, (82%) patients were male with a mean age of 41.67 (SD 17.47) years[23]. In addition, Bhatti et al, (2015) revealed that, over three quarters (79.3%) of patients were males and almost half (46.4%) were aged < 25 years[24].In contrast with this study, English et al, (2013) reported that the mean age ranged from 29.5 to 41.4 years [22].

From the researcher point of view, the predomination of male over female in head trauma can be explained by the fact that males are more involved in outdoor activities and are more prone to trauma during driving and traffic accidents (the most common cause of head injury) than females. These characteristics are similar to the general head injury population in Egypt. Also, the higher frequency of head injury in youth can be explained as this age is the most active period in the life and are vulnerable to trauma.

The current study concluded that, there were no significant statistical differences in age and gender between the studied groups. This data is agreed with Damkliang, Considine, Kent & Street (2015) who reported that, there were no significant statistical differences in gender and age of patients with severe TBI in the pretest and post-test periods [25]. in contrast with this results, Salama, Maray, &Hamed (2015) concluded that, unfavorable outcome had statistical high significant (p value (<0.001*)) relationship with age of the patient [21].

The current study delineated that the majority of the study sample in both control and study groups were matched in the clinical presentations represented in presence of scalp wound or fractures, extra cranial injuries, and GCS mean 6.90 for control group and 7.50 for study group, and no past medical history, with no significant statistical differences between the both groups. The current study is agreed with study conducted by Mohamed et al, (2018) which highlighted that, there was a reasonable homogeneity in terms of clinical presentation, with most participants presented with a no penetrating head injury secondary to a motor car accident, as well as polytrauma, a GCS between 6–8 and the absence of any comorbidities (past medical history) [15]. Also, Awad, Ahmed, &Kandeel (2022) illustrated that, the median of the GCS among the bundle group on admission was less than the control group (6 & 7 respectively) with no statistically significant difference between them [13].

The current study showed that around one third of the control and study groups were diagnosed as SDH. Regarding mechanism of injury, this study revealed that, near two- thirds of the both groups' mechanism of injury was Motor car accident (MCA) in both groups.Agreed with this result Ziaeirad, Alimohammadi, Irajpour & Aminmansour (2018) who revealed that the most common findings of the initial brain CT scans were subdural hematoma (27.59%) [26]. Also, Galkin (2016) reported that the incidence of subdural hematomas is within the range of 10 to 30% of traumatic brain injuries and is more common in severe injuries, which are caused mostly by road traffic accident in young age [27]. In addition, the study conducted by dSamanamalee, S., et al, (2018) reported that over 2/3rds (68, 67.3%) of the patients were after RTAs while nearly everyone else (25 patients, 24.8%) were subsequent to falling from a height [23].

Moreover, the study conducted by Mohamed et al., (2018) highlighted that the event most likely to lead to TBI in both groups was a motor car accident, which represented 49.9% of cases in the intervention group and 56.3% of cases in the control group and falling from a height (20% and 6.7%) [15]. Also, Salama, Maray & Hamed (2015) reported that motor vehicle accident was the most common cause of head trauma, which contributed to 71% of the total [21]. Besides, Awad, Ahmed, & Kandeel (2022) reported that the main cause of injury was road traffic accidents [13]. In addition, Bhatti et al, (2015) highlighted that, mechanisms of TBI were reported in 370 patients (20.7%), in whom the most common were road traffic crashes (48.6%) followed by falls (22.4%) [24].

The current study concluded that mechanism of injury did not affect the outcome of head trauma as there is no significant statistical difference between mechanism of injury and the study outcomes. These results agreed with Salama, Maray & Hamed (2015) who reported that, mode of injury whether road traffic accident, history of fall or assault did not affect the outcome of head trauma [21]. Also, the study conducted by Samanamalee et al, (2018) concluded that, there was no significant association between survival, or length of ICU stay and road Traffic accidents (RTA) and fall (p = 0.777) [23]. Moreover, the current study is congruent

with the study conducted by Damkliang et al, (2015**)** which highlighted that, there were no significant differences in the mechanism of injury of patients with severe TBI in the pretest and post-test periods [25].

The current study highlighted that almost all of the studied sample didn't receive pre-arrival (pre-hospital) management, three-quarters of the studied sample attended to the emergency by ambulance and around half of them spent less than 1 hour before arrival to emergency department, with no significant statistical differences between the study groups. In the same way Bhatti et al, (2015) reported that, 66% of severe TBI patients arrived by ambulances, whereas the others arrived by other transport [24]. Also, Røeet al, (2013) showed that the median time of transport to the first hospital was 60 min [28]. in addition, this data is agreed with Damkliang et al, (2015**)** as they reported that there were no significant differences in the referring system (transportation ways) of patients with severe TBI in the pretest and post-test periods [25].

From the researcher's point of view, the cause of no pre-hospital management was delivered to severely brain injured patients may be because of lack of paramedic skills regarding advanced trauma life support and no available pre hospital physician accompanying ambulance during transfer of trauma patients from the scene to the hospital in Egypt. Regarding pupil assessment, it was cleared that, around two thirds (65%) and more than half (55%) of the control and study groups had abnormal pupil size and reaction (unequal size/sluggish pupil reaction or dilated) with no significant statistical differences at the first time assessment ,while the majority (80%) and more than half (55%) of them had abnormal size and reaction at the transfer time to ICU or operating room respectively, with a significant statistical differences between the studied groups and this results support hypothesis one indirectly as pupil abnormalities reflect increased intracranial pressure and subsequent secondary brain injury. These results agreed with Awad, Ahmed &Kandeel (2022) who reported that, there was a statistically significant difference between both study and control groups on follow-up as regards pupil responses [13].

Moreover, the study conducted by Ziaeiradet al, (2018) reported that GCS and pupil response were recognized as the most important prognostic factors of outcome (frequency of secondary injuries and in-hospital mortality rate secondary injuries) [26]. Also, Zhao et al, (2021) concluded that GCS score and pupil reactivity are the best indicators of survival [29]. In addition, Sobuwa, Hartzenberg & Geduld (2014) highlighted that, having bilateral reactive pupils increased the odds of a good outcome by 340.5% [30].

From the researcher's point of view, pupil responses had a reflection on serious signs of neurological disorders. as poor or worsening pupil responses (unequal, dilated, sluggish or nonreactive pupil) may indicate increased intra cranial pressure. So, maintaining baseline pupil responses within normal can give positive feedback on maintaining intra cranial pressure and subsequently absence of signs of secondary brain injury. The current study highlighted that more than half (55%) of the control group was transferred to ICU, while around two thirds (65%) of the study group were transferred to ICU and half (50%) of the both groups were transferred within 4 hours from emergency admission. In accordance with these results Damklianget al, (2015**)** reported that, more patients from the post-test group were transferred from ED to ICU [25].

The current study concluded that there were significant statistical differences between the studied groups regarding the prevention and reduction of signs of secondary brain injury represented in (heart rate, respiratory rate, oxygen saturation, CO_2, blood glucose level, PH, and convulsion) after implementing the clinical nursing guidelines to the study group. Thus, hypothesis one can be supported. This is consistent with the study conducted by Damklianget al. (2015), which found that evidence-based emergency nursing care of severe traumatic brain injuried patients decreases needless differences in nursing care and reduces the risk of secondary brain injury from suboptimal care as there were notable improvements in clinical care for those patients after applying the care bundle [25].

Moreover, Mohamed et al, (2018) reported that, participants receiving care guided by the TBI clinical pathway demonstrated significantly fewer cases of hyperglycemia than participants receiving usual care [15]. Also, Bhatti et al, (2015) reported that, management protocols used for the treatment of severe TBI patients were associated with a significant increase in favorable neurologic outcomes [22]. In addition, the results of the study are consistent with other studies indicating that implementation of care bundles in emergency care improve clinical outcomes in different groups of patients [25].

The current study revealed that all patients in the study group survived while one (5%) in the control group died with no significant statistical differences between the control and study groups in reducing frequency of mortality. This result didn't support hypothesis two. In accordance with this study, Awad, Ahmed &Kandeel (2022) reported that, all patients in the bundle group were still alive after the implementation of the evidence-based care bundle for TBI patients, while two patients (7.7 %) in the control group died. However, this difference between patients who were still alive in both groups did not achieve statistical significance[13]. Also, Damkliang et al, (2015**)** reported that, there were two deaths in the pretest group compared with no deaths in the post-test group [25].

From the researcher's point of view, the rational of the nonsignificant statistical differences between control and study groups in reducing the frequency of mortality was due to limited data collection to a few hours that patient spent in the emergency department before transfer to ICU or OR, while the mortality may occur within I day or more in ICU or OR and the follow up after transfer is not targeted in the current study. And this opinion is supported by Røeet al, (2013) who concluded that, Eighty-six percent of the deaths occurred within 2 weeks and the median time from the accident to death was within 1 day in the adult subjects and 2 days in the elderly subjects [28].

4. Conclusion

The adapted clinical nursing guidelines in the emergency setting are evidence-informed recommendation for emergency nursing care of patients with severe traumatic brain injury and is an important method for promoting consistency and decreasing unnecessary variations in nursing care. The study finding reported that applying clinical nursing guidelines in management of patients with severe traumatic brain injuries can improve patient outcomes (preventing

secondary brain injury and reducing frequency of mortality in the emergency department). Also, the importance of early application of these guidelines and its positive effect on patient outcomes is highlighted.

5. Recommendations

- Implementation of adapted clinical nursing guidelines in the management of patients with severe traumatic brain injuries in emergency setting.
- Continuous monitoring of patients with severe traumatic brain injuries in emergency setting for early detection of neurological or systemic disorders.
- Replication of the study on a larger probability sample from different geographical locations in Egypt.
- Studying the prehospital and post emergency period and their effects on severe traumatic patient' outcomes.

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Conflict of Interest

No conflict of interest

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