Cerebral Perfusion Pressure among Acute Traumatic Brain Injury Patients at Supine versus Semi-Fowler Positions

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Abstract

Background: Positioning is one of the most frequently performed nursing activities in the intensive care units. However literature review documented lack of knowledge about the relationship of cerebral dynamics and different body positions among acute traumatic brain injury patients. **Aim:** the aim of this study is to assess the effect of supine and semi-fowler position on cerebral perfusion pressure among patients with acute traumatic brain injuries at Cairo University Hospital as indicated by: Glasgow coma score (GCS), arterial blood gases values (ABG), oxygen saturation and vital signs (pulse, blood pressure and respiratory rate). **Research questions:** What is the effect of supine position on cerebral perfusion pressure among patients with acute traumatic brain injuries? And what is the effect of semi fowler position on cerebral perfusion pressure among patients with acute traumatic brain injuries? **Sample:** Convenience sample of 39 patients admitted with acute traumatic brain injury. **Design:** Descriptive exploratory repeated measures study. **Setting:** University Hospital in Cairo. **Tools:** Initial acute traumatic brain injury patient's assessment sheet, and cerebral oxygenation and physiological parameters assessment sheet for acute traumatic brain injury patients. **Result:** The mean age was 28.5 ±7.9 years. (74.4%) have normal body weight, (25.6%) were having cerebral contusion. Significant increase of CPP, Pao2, SaO2, SPO2, mean arterial pressure and systolic blood pressure, in 15 min post semi-fowler position assessment with a significant decrease of PaCo2. Significant decrease of pulse rate in supine position was evident. With no significant changes in diastolic blood pressure and GCS. **Conclusion:** Semi-fowler position was found to affect the ABG values, mean arterial pressure, respiratory rate, SpO2 and CPP positively. **Recommendation:** Studying the effect of side lying and prone position to establish data base about the optimal body position for acute traumatic head injury patients is highly recommended with replication of this study on larger probability sample.

Key words: supine position, semi-fowler position, physiological parameters, cerebral perfusion pressure, acute traumatic brain injury.

1. Introduction:

Traumatic brain injury (TBI) is a leading cause of death worldwide, particularly in those younger than 40 years. Head injury and TBI are two distinct entities that are often, but not necessarily, related. A head injury is best defined as an injury that is clinically evident upon physical examination and is recognized by the presence of ecchymoses, lacerations, deformities, or the presence of rhinorrhea or otorrhea. Traumatic brain injury refers to an injury to the brain itself and can occur without external signs of trauma (Macias, et al. 2009).

Traumatic brain injury is a major source of disability, death and cost (emotional and financial) to society. It is important to recognize that the neurological damage that occurs often develops after the initial impact damage and it is the control of this secondary brain injury that is imperative. With the control of secondary brain injury, the patient's prognosis improves; this has been demonstrated by progressive and significant reductions in mortality from 50 to 35 to 25% (and lower) over the last 30 years (Lu et al. 2005). This has largely occurred because of a change in focus on patient management with the emphasis on promotion of adequate cerebral perfusion. To enable this, protocols that focus on maintenance of neuronal perfusion have been developed and introduced into practice (Sarah. McGloin, Anne & McLeod, 2010).

Cerebral perfusion pressure (CPP) is the difference between the arterial pressure in the feeding arteries as they enter the subarachnoid space and the pressure in the draining veins before they enter the dural sinuses. As both of these pressures are difficult to measure, CPP is seen to be the difference between mean arterial pressure (MAP) and ICP or CVP (as an estimate of tissue pressure). The cerebral blood vessels will constrict or dilate to maintain a stable CPP: this ability to auto regulate blood flow through the cerebral vasculature is a key to ensuring that perfusion is constant. The diameter of the cerebral vessels change inversely with changes in pressure: as the CPP rises, the vessels constrict and if CPP reduces, the vessels dilate. CPP is a surrogate for CBF that is commonly utilized at the bedside in the Neuroscience ICU, CPP between 60 and 80 mmHg is commonly targeted (Bhardwaj & Mirski, 2011).

While the exact effects of body position, a critical component of basic nursing care in the intensive care units (ICU), on intracranial physiology after traumatic brain injury are not well defined, the current practice in most neurocritical care units is to elevate the head of the bed in an effort to reduce intracranial pressure by facilitating venous outflow without compromising cerebral perfusion pressure (CPP) and cardiac output (Brain Trauma Foundation, 2007). On the contrast, it has been suggested that the horizontal position (supine) reduces the risk for systemic hypotension. Furthermore, some authors argue that a horizontal body position increases cerebral perfusion pressure improving cerebral blood flow (Winkelman, 2012). However the American Association of Neurological Surgeons has not referred to head position in their most recent guidelines, Brain Trauma Foundation (2010) does not include specific recommendations for optimal patient positioning practices after severe brain injury, and Similarly, guidelines on care of subarachnoid haemorrhage (SAH) patients are unclear about optimal patient position (Blissitt, Mitchell & Newell, 2011).

Turning and repositioning also may be associated with transient increases in ICP and subsequent changes in cerebral and cardiovascular variables (Price, Collins, & Gallagher, 2003). In a literature review on positioning for diverse patient populations, Sullivan (2000) suggests that caution should be used with side-lying positions and HOB elevation no greater than 45[degrees] should be used for TBI patients. Varying degrees of head elevation have been associated with changes in jugular venous outflow, intracranial pressure, cerebral perfusion pressure, and cerebral tissue oxygenation. Head elevation is generally presumed to be associated with enhanced jugular venous outflow and decreased intracranial pressure. However, the relationship between head elevation and cerebral perfusion pressure and cerebral tissue oxygenation is less clearly understood (Fan. 2004 & Marklew. 2006).

Nursing care of the head-injured patient can present many challenges for the critical care nurse and, as a consequence, a thorough knowledge of the hemodynamics and neuro-dynamics sequence of traumatic brain injury is required. To answer the question of the optimal body position for traumatic brain injury patients in these times of evidence-based practice there is clearly a need for many researches to be undertaken in many areas in the care of the head-injured patient (Bratton et al., 2007). Therefore, the aim of this study is to assess the effect of different body positions (supine and semi-fowler position) on cerebral oxygenations and physiological parameters among patients with acute traumatic brain injuries at Cairo University Hospital as indicated by: Glasgow coma score (GCS), Arterial blood gases values (ABG), Oxygen saturation by pulse oximeter and Vital signs (pulse, blood pressure and respiratory rate).

2. Significance of the study:

Until now, the question of optimal body position for brain-injured patients has not been addressed in systematic studies and It has been observed from clinical experience that patient's position changes are always done as a routine, choosing the appropriate body position for performing the nursing activities, in addition frequently performed nursing activities in the critical care units for all the patients to prevent integumentary complication with less consideration to patients' hemodynamics. However there is lack of knowledge about the relation of cerebral dynamics and different body positions (Fan. 2004 & Marklew. 2006), since cerebral oxygenation and physiological parameters play a crucial role in hemodynamic stability of traumatic brain injured (TBI) patients. Thus the present study conducted in an attempts to establish data base information about hemodynamic and oxygenation parameters in different body positions (supine & semi-fowler position) this might generate knowledge to help nursing professionals in planning care for such a group of patients as well the other health professionals, in addition it could have a positive effect upon health status of the similar group of patients.

3. Aim of the study:

The aim of this study is to assess the effect of different body positions (supine and semi-fowler position) on cerebral oxygenations and physiological parameters among patients with acute traumatic brain injuries at Cairo

University Hospital as indicated by: Glasgow coma score (GCS), Arterial blood gases values (ABG), Oxygen saturation by pulse oximeter and Vital signs (pulse, blood pressure and respiratory rate).

4. Research questions:

To fulfill the aim of this study the following research questions were formulated:

Q1: What is the effect of supine position on cerebral oxygenations and physiological parameters among patients with acute traumatic brain injuries?

Q2: What is the effect of semi fowler position on cerebral oxygenations and physiological parameters among patients with acute traumatic brain injuries?

5. Subjects and Methods:

5.1 Research Design

Descriptive exploratory design was adopted in the current study; single center repeated measures used to describe the effect of supine and semi-fowler positions on physiological parameters and cerebral oxygenations among acute traumatic brain injury patients.

5.2 Setting

The study was carried out at Emergency Department at one University Hospital, in Cairo Governorate. It is one of the largest educational university hospitals in Egypt in this field, and it receives patients from all governorates of Egypt and other countries. The neurosurgery ICU unit consists of (12 beds), and intermediate unite consists of (10 beds). The number of occupied bed in ICU is 12 beds. The unit receives patients with Varity of diagnosis such as traumatic brain injury (TBI), spinal cord injury, brain tumor, and spontaneous cerebral hemorrhage for preoperative, postoperative and conservative management.

5.3 Subjects

Convenience sample of 39 adult male and female patients who are diagnosed as having brain injury with GCS between 3 & 14, were recruited to fulfill the aim of this study within the first 48 hours of hospital admission. With the following exclusion criteria Spinal cord injury, diabetic, hypertensive's, chronic obstructive pulmonary disease patients (COPD) , body mass index of more than 30 kg/m2, Shocked, feverish (temperature of more than 38 degree), and those with respiratory acidosis.

5.4 Tools

Two tools were formulated to collect data pertinent to this study. These tools were constructed by the researcher and revised by a panel of 5 medical and critical care nursing experts then piloted on 5 patients to ensure clarity, objectivity, relevance, and feasibility of the study tools and to establish the Content and face validity of these tools. These tools are:

1- Initial acute traumatic brain injury patient's assessment sheet: This sheet covering 3 main parts: Part (1): covers the socio-demographic data such as (age, gender and admission date). Part (2): is related to general medical data: this part contain data related to patient diagnosis, past medical history, oxygen devices used, prescribed medications, Glasgow coma scale and body mass index. Part (3): devoted to the initial vital signs assessment; containing assessment of pulse, systole, diastole and mean blood pressure, respiratory rate and central venous pressure.

2- Cerebral oxygenation and Physiological parameters assessment sheet for acute traumatic brain injury patients. This sheet contains items covering 3 main parts: Part (1): Includes assessment of physiological parameters: such as (pulse rate, systolic blood pressure, diastolic blood pressure, mean blood pressure and respiratory rate). Part (2): deals with assessment of consciousness using Glasgow coma scale. Part (3): provide data related to assessment of cerebral oxygenation: through arterial blood gases values (SaO_2, PaO_2 and $PaCo_2$), oxygen saturation level by pulse oximeter.

5.4.1 Tools validity

Content validity was done to identify the degree to which the used tools measure what was supposed to be measured. Tools developed by the investigator were examined by a panel of five medical and critical care nursing experts to determine whether the included items are clear and suitable to achieve the aim of the current study.

5.5 Ethical consideration

An official permission to conduct the study was obtained from directors of the Critical Care department at the University Hospital. Written consents were obtained from head nurses; in addition, patients' agreements to be included in the study were obtained after explanation of the nature and purpose of the study. Each patient was free to either participate or not in this study and had the right to withdraw from the study at any time without any rationale; also, patients were informed that data will not be included in any further researches without another new consent if they do not mind. Confidentiality and anonymity of each subject were assured through coding of all data.

5.6 Techniques for data collections

Structured interview, reviewing medical /nursing records and direct patients observation were utilized to fill out the study tools.

5.7 Procedure

The current study was carried out on two phases, designation and implementation phases which are:

5.7.1 Designation phase:

It was concerned with the construction and preparation of the different data collection tools, in addition to obtaining managerial arrangement to carry out the study.

5.7.2 Implementation phase:

The investigator visited the ICU of neurosurgery on daily bases, during morning and afternoon shifts reviewing the medical and nursing records to identify the patients who matched the inclusion criteria. Then formal consent was taken to be included in the study after explaining the purpose and the nature of the study. The patients were assessed during the first 48 hours of the patients' admission. Body mass index was calculated for all adult acute traumatic brain injury patients who were fulfilling the inclusion criteria; those with BMI of less than 30kg/m2 were included in the study. Then the Socio demographic and medical related data were obtained and recorded from the patients' files (tool 1), initial patient assessment of base line vital signs, GCS, oxygen saturation, ABG values, oxygen device used, and the medication used were done and result documented.

Cerebral oxygenation and Physiological parameters assessment sheet for acute traumatic brain injury patients (Tool 2), were fulfilled by the researcher through direct observation before changing position and 15 minutes after changing position in the two selected position (supine & semi-fowler position) this was checked three times on different intervals for each patient in each position to obtain the mean value for each position.

5.8 Statistical analysis data

Upon completion of the data collection, data were tabulated and analyzed using SPSS program; relevant statistical analysis was used to test the obtained data. Descriptive statistics were applied (eg. mean, standard deviation, frequency, percentage). Also t-test and one way repeated measure ANOVA test were applied using the significant level $p \leq 0.05$.

6. Results

Statistical finding of the current study are presented in three main sections; section one is related to the socio-demographic and medical data of the studied subjects. Section two is devoted to the answers of the two stated research questions and section three is delineated to the additional correlational findings.

Section one: Socio-demographic and medical data of the studied subjects: Figures (1-5) are related.

Figure (1) shows that more than half of the stuided sample (56.4 %) their age ranged from 25 to 30 years old with a mean age of 28.5±7.9.

Figure (2) shows that the majority of the studied subjects (92.3%) were males.

Figure (3) shows that the majority of the studied sample (74.40%) their body mass index ranged between 20 & 25 Kg/m2 (normal weight).

Figure (4) shows that (25.6%) of the studied sample were diagnosed as having cerebral contusion, followed by (23.1%) with intracerebral hemorrhage, (17.9%) with extradural hematoma, (15.4%) with subdural hematoma, (7.7%) with skull fracture and equal percentages (5.1%) were having cerebral hematoma and subarachnoid hemorrhage.

Figure (5) shows that the highest percentage of the studied sample (33.3%) were connected with t-tube for oxygen therapy, (28.2%) were connected to oxygen mask, (23.1%) were on room air, and (15.4%) were mechanically ventilated.

Section two: This section is devoted to the answers of the two stated research questions. Tables (1- 3) are related to the answer of these research questions.

Table (1); denotes that there a significant increase in cerebral perfusion pressure(CPP), systolic blood pressure, mean arterial pressure, SpO2 with significant decrease of respiratory rate in 15 min post semi-fowler position. Significant increase of pulse rate in supine position. With no significant changes in diastolic blood pressure and GCS.

Table (2); denotes that there is a highly significant increase of PaO2, SaO2 and decrease of PaCo2 in the 15 min post semi-fowler position.

Table (3) Table (3): illustrates no significant changes of initial GCS with pre and post supine and semi-fowler GCS scores.

7. Discussion:

Discussion of the results obtained from the current study are presented in two main sections; section one specified to describe the studied group as regards to their socio-demographic characteristics and medical data. The second section is concerned with answering the research questions.

Section 1: socio-demographic characteristics and medical data:

The current study revealed that more than half of studied subjects age ranged from 25 -30 years old, male subjects represent the great majority, three quarter of them have BMI ranged between 20-25 kg/m2, quarter of the studied subject were diagnosed as brain contusion, and more than quarter of the studied subject were connected with t-tube for oxygen therapy.

The rational for these findings may be due to the male in this age group are more likely to engage in activities that make them more vulnerable for head trauma (like driving, sports, and fights). The body mass index for the studied subject was classified as normal weight this may be due to increased activity in this age and life style. The main cause is road traffic accidents, cars crashes which are more associated with cerebral contusion as a result of mechanism of injury.

The current study revealed that more than half of the stuided subjects their age ranged from 25 to 30 years old. These findings are in concordance with (Styrke, 2007) who reviewed Traumatic brain injuries in a well-defined population: epidemiological aspects and severity, indicated that Median age of traumatic brain injury patients was 23 years. Also (Fitzharris, Dandona, Kumar, & Dandona, 2009) who studied Crash characteristics and patterns of injury among hospitalized motorized two-wheeled vehicle users in urban India stated that median age was 31 years and the great majority were male.

Male patients represent the great majority of the studied subjects in the current study. This finding is in concordance with (BMJ, 2008) who studied Predicting outcome after traumatic brain injury: practical prognostic models based on large cohort of international patients mentioned that the majority (81%) of the patients were male.

The current study revealed that three quarter of the studied subjects their body mass index was ranged between 20 to 25. In this regards (Brown, et al, 2006) studied obesity and traumatic brain injury, found that the great majority was lean patients have normal weight (BMI = 24 +/- 4 kg/m2).

The current study revealed that more than one quarter of the study subjects were diagnosed as having brain contusion in this regards (Narotam, Morrison, & Nathoo, 2009) who studied brain tissue oxygen monitoring in traumatic brain injury and major trauma: outcome analysis of a brain tissue oxygen-directed therapy, found that The majority of injuries were sustained in motor vehicle crashes, and diffuse brain injury was the most common abnormality.

The current study revealed that more than half of the studied subjects was connected with t-tube for oxygen therapy in this regards (Elm, Schoettker, Henzi, Osterwalder, & Walder, 2009) studied pre-hospital tracheal intubation in patients with traumatic brain injury: systematic review of current evidence: a systematic literature search reported that the available evidence did not support any benefit from pre-hospital intubation and mechanical ventilation after traumatic brain injury (TBI). Additional arguments need to be taken into account, including medical and procedural aspects.

Section two: This section is concerned with answering the research questions:

The current study revealed statistical significant increase of systolic blood pressure, mean blood pressure, cerebral perfusion pressure (CPP), SpO2 and significant decrease of respiratory rate in semi-fowler position. Significant increase of pulse rate in supine position, and no significant changes of GCS in different position. There was highly significant statistical increase of PaO2, SaO2 and decrease of PaCo2 in the 15 min post semi-fowler position.

The underlying rational for this result may be due to the role of semi-fowler position in decreasing ICP and as a result of this improvement of CPP. Increased oxygenation and decreased PaCo2 may be due to in the semi-fowler position tidal volume increased due to lowering of diaphragm and increase alveolar expansion. The semi-fowler position maximizes lung volumes, flow rate and capacities increases spontaneous tidal volumes, and decreases the pressure on the diaphragm exerted by abdominal contents, increase in respiratory system compliance so oxygenation increased and PaCo2 decreased.

The current study revealed statistical significant increase of systolic blood pressure, mean blood pressure, SpO2 and significant decrease of respiratory rate in semi-fowler position. Significant increase of pulse rate in supine position. In contrast with these finding (Ledwith et-al, 2010) who studied effect of body position on cerebral oxygenation and physiologic parameters in patients with acute neurological conditions, found that. Hemodynamic parameters were similar in the various positions. Also (Palazón, Asensi, López, Bautista & Candel, 2008) who studied effect of head elevation on intracranial pressure, cerebral perfusion pressure, and cerebral blood flow in patients with cerebral hemorrhage, stated that ICP were significantly higher in horizontal position and all the physiological parameters were not significantly affected by the change in head elevation.

Also (Wojner, Alexander, Garami, Chernyshev, & Alexandrov, 2005) who studied Heads down Flat positioning improves blood flow velocity in acute ischemic stroke stated that middle cerebral artery (MCA) mean flow velocity (MFV) increased in all patients with lowering head position to 0 degree , Mean arterial pressure and heart rate were unchanged throughout the intervention, Immediate neurologic improvement occurred in three patients (15%) after lowering head position, and concluded that acute ischemic stroke patients may benefit from lower head-of-the-bed positions to promote residual blood flow to ischemic brain tissue.

Also (Eser, Khorshid, Gunes, & Demir, 2007) stated that the blood pressure tended to drop in the standing position compared with the sitting, supine and supine with crossed legs. Systolic and diastolic blood pressure was the highest in supine position when compared with the other positions. There was a difference between systolic blood pressures and this was statistically significant, but the difference between diastolic blood pressure was not statistically significant. All changes in systolic blood pressure were statistically significant except those from supine to supine position with crossed legs.

Also (Emerson & Banasik, 2006) studied effect of position on selected hemodynamic parameters in postoperative cardiac surgery patients (supine, 45 degrees right lateral, and 45 degrees left lateral) stated that Statistically significant differences were found in response to position in systolic and diastolic blood pressure, central venous pressure, and heart rate. Certain positions produced greater changes in selected variables, both in the total group and within specific subgroups.

The current study revealed significant increase of the cerebral perfusion pressure (CPP) in semi-fowler positions this finding in concordance with (Winkelman. 2012) who studied Effect of backrest position on intracranial and cerebral perfusion pressures in traumatically brain-injured adults found that Use of backrest elevation of 30 degrees resulted in significant improvements in CPP.

Meyer, Teasell, Megyesi, & Bayona (2012) in evidence-based review of moderate to severe acquired brain injury stated that there is level 2 evidence based on one randomized control trial (RCT) that 30 degrees of head elevation reduces intracranial pressure with concomitant increments in cerebral perfusion pressure. Elevating the head by 30 degrees improves intracranial and cerebral perfusion pressures. Also (Meixensberger, Baunach, Amschler, Dings, & Roosen 1997) who studied Influence of body position on tissue-pO2, cerebral perfusion pressure and intracranial pressure in patients with acute brain injury stated that Compared with the 30 degree head position ICP was significantly higher and CPP significantly lower at the 0 degrees head position. Brain tissue oxygenation (ti-pO2) and mean arterial blood pressure were unaffected by head position.

The current study revealed that there is no statistical significant change of diastolic blood pressure and GCS in the initial, supine and semi-fowler position this finding in concordance with (Ledwith, Bloom, Wilensk, Coyle, Polomano & Roux, 2010) who studied the effect of body position on cerebral oxygenation and physiological parameters among patients with acute neurological conditions found that no significant changes of physiological parameters recorded with changes in head elevation.

The current study revealed a highly significant statistical increase of PaO2, SaO2 and decrease of PaCo2 in the 15 min post semi-fowler position these finding in concordance with (Shah, 2012) studied the comparison of effect of semi fowler's vs. side lying position on tidal volume & pulse oxymetry in ICU patients found that PaO2 significantly increased and PaCo2 significantly decreased in semi-fowler position.

In contrast (Tyson & Nightingale, 2004) in studying the effects of position on oxygen saturation in acute stroke: a systematic review stated that there was strong evidence that body position did not affect oxygen saturation in acute stroke patients without relevant (respiratory) co-morbidities. There was limited evidence that sitting in a chair had a beneficial effect and lying positions had a deleterious effect on oxygen saturation in acute stroke patients with respiratory co-morbidities, and concluded that acute stroke patients without respiratory co-morbidities can adopt anybody position, people with respiratory co-morbidities should be positioned as upright as possible.

Also (Safari, Ansari, & Mohsen, 2002) who studied the effect of body position on arterial oxygen saturation in acute stroke stated that mean arterial oxygen saturation values for all patients were >90% for the hour spent in each test position for all patients. There were no changes in arterial oxygen saturation across the hour spent in the test positions (repeated-measures analysis of variance). No differences in arterial oxygen saturation were identified among positions (analysis of covariance).

The current study revealed that the pulse rate significantly increased in the supine position in contrast to these finding (Palazón, Asensi, López, Bautista & Candel, 2008) who studied Effect of head elevation on intracranial pressure, cerebral perfusion pressure, and cerebral blood flow in head-injured patients found that physiological parameters were not affected by changes in head elevation.

The current study revealed highly significant decrease of respiratory rate in the 15 min post semi-fowler position in contrast to these finding (Naylor, 2006) who studied a modified postural drainage position produces less cardiovascular stress than a head-down position in patients with severe heart disease: a quasi-experimental study, found there were no significant respiratory responses to either postural drainage manoeuvre.

Elizabeth & Winslow, (2012) stated that the right position made breathing easier, since respiratory rate was significantly lower in the right position compared with the high Fowler's position, while tidal volume was significantly higher in the right position compared with the high Fowler's. Respiratory rate was also significantly lower in the 45[degrees] position compared with the 90 degrees position, and mean heart rate was significantly higher in high Fowler's than in the flat position. Most patients preferred the right or 45 degrees positions.

The current study revealed that the systolic, and mean arterial pressure were significantly increased in the semi-fowler position and this disagree with (Meixensberger, Baunach, Amschler, Dings, & Roosen 1997) who studied the influence of body position on tissue-pO2, cerebral perfusion pressure and intracranial pressure in patients with acute brain injury who found that the blood pressure were unaffected by head position.

Also (Shahdadi, Mazloum, Badakhsh, & EsmatBandani, 2010) studied Comparison of blood pressure in the supine and semi-Fowler's position during hemodialysis, reported that There was no statistical significant difference between two positions in terms of hypotension . The mean systolic blood pressure in supine and Fowler's position were 117.7 and 113.11 mm/Hg, respectively. The mean diastolic blood pressure in supine and Fowler's position were 66 and 65.5 mm/Hg, respectively and there was no statistical significant difference between two positions in terms of diastolic blood pressure.

The current study revealed a highly significant increase of SpO2 in the 15 min post semi-fowler position. In contrast to this finding (Shah, 2012) studied the comparison of effect of semi fowler's vs. side lying position on tidal volume & pulse oxymetry in ICU patients found that SpO2 not affected by positions. Also (Smith, Harten, Jack, Carter, & Kinsella, 2010) who studied pre-oxygenation in healthy volunteers: a comparison of the supine and 45° seated positions stated that there was no difference in the increase in tissue oxygenation when comparing the supine and seated positions, and conclude that there is no evidence that pre-oxygenation in the 45° seated position improves tissue oxygenation in young healthy volunteers compared with the supine position.

Also (Safari, Ansari, & Mohsen, 2002) studied: study of semi-fowlers position and its duration effect on the arterial blood gases results in patients under mechanical ventilation hospitalized in general ICU the findings showed that semi-fowler's position did not have any positive effects on oxygenation and gas exchange. Also, the findings indicated that the effect of lying duration (15, 30, 45, 60 minutes) in semi-fowler's position on oxygenation and gas exchange wasn't significant.

8. Conclusion:

Based on the result of the current study, it can be concluded that the semi-fowler position has positive effect on cerebral dynamics as it helps in improving the cerebral perfusion pressure (CPP), hemodynamic parameters as mean and systolic blood pressure, respiratory rate, and oxygenation parameters in the form of oxygen saturation (SpO2), and arterial blood gases values (PaO2, SaO2, and PaCo2).

9. Recommendations:

1. Replication of the study on a larger probability sample selected from different geographical areas in Egypt is recommended to obtain more generalizable data.
2. Further studies should be carried out in order to assess the effect of other body positions.

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Figure (1): Percentage distribution of the studied sample as regards to their age groups (n =39).

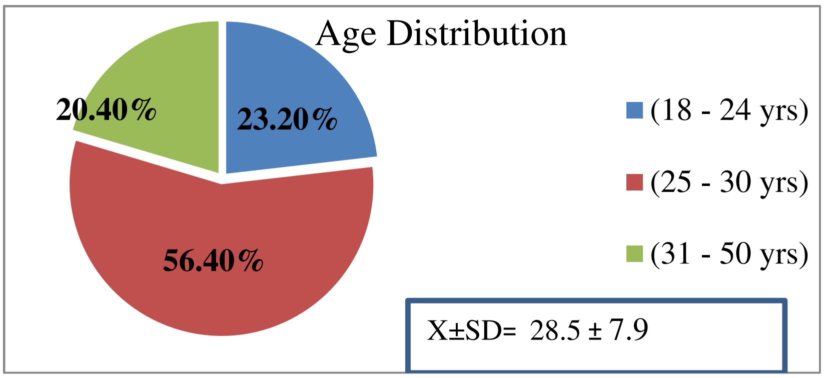

Figure (2) Percentage Distribution of the Studied Sample as regards to Their Gender (n =39).

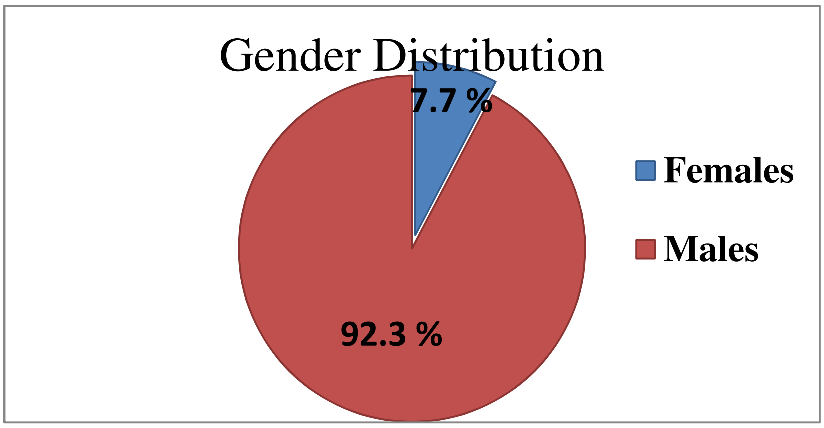

Figure (3) Percentage distribution of the studied sample as regards to their body mass index (bmi) (n =39).

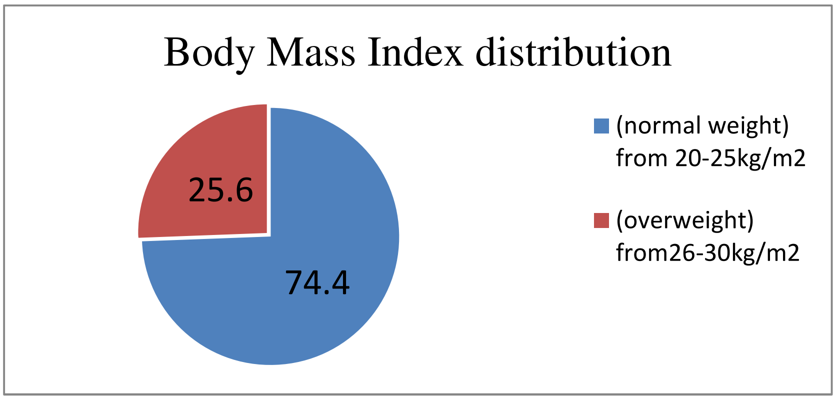

Figure (4) Percentage distribution of the studied group as regards to their brain injury pathology (n =39)

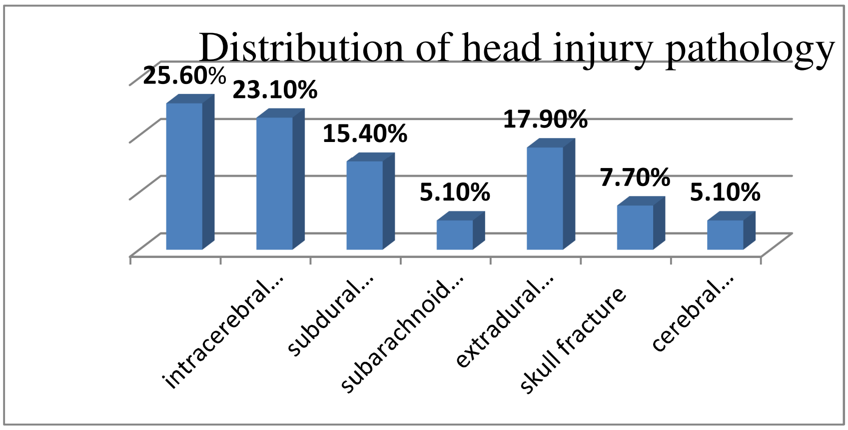

Figure (5): Percentage distribution of the studied sample as regards to their oxygen therapy device used (n =39)

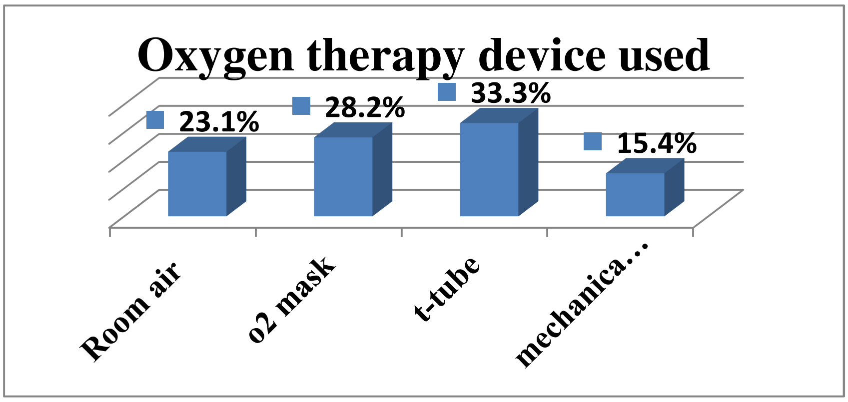

Table (1); One way ANOVA for vital signs, SpO2 and GCS during the five assessments for the studied subjects (n = 39).

Variable	Initial assessment $\bar{X} \pm SD$	Supine position		Semi-fowler position		F /P
		Pre	15 minutes Post	Pre	15 minutes Post	
		$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Pulse rate	91 ± 19.8	100 ± 9.8	95± 21.2	98 ± 20.3	97 ± 23	3.272/.022*
Respiratory rate	24 ± 3.3	21 ± 4.4	21 ± 5.2	22 ± 5.5	21 ± 5.2	3.670/.013*
Systole BP	124 ± 13.5	128 ± 4.5	128 ± 15	130 ± 15	128 ± 4.7	2.743/.044*
Diastole BP	79 ± 11.5	77 ± 11	77 ± 11.3	78 ± 11.1	78 ± 9.5	2.046/.109
Mean BP	95 ± 12.8	94 ± 12.2	94 ± 12.5	97 ± 13.3	96 ± 12.7	4.366/.006**
SpO2	94 ± 6.4	97 ± 5.1	98 ± 1.6	98 ± 1.9	99 ± 1.8	5.791/.001**
GCS	8 ± 3.5	8 ± 3.7	8 ± 3.7	8 ± 3.7	8 ± 3.7	.061/.806
CPP (n=30)	86 ± 12.5	86 ± 12	86 ± 12.6	89 ± 13	88 ± 12	4.36/.006**

GCS Glasgow coma scale.

CPP Cerebral perfusion pressure. (CPP = MAP - CVP).

CVP Central venous pressure. $\bar{X} \pm SD = (8 \pm 1.7)$.

BP Blood Pressure

Table (2) ; One way ANOVA for arterial blood gases value during initial assessment, 15 min post supine position and 15 min post semi-fowler position for the studied subjects (n = 39).

Variable	Initial assessment $\bar{X} \pm SD$	15 min post supine position	15 min post semi-fowler position	F /P
		$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Pao2	87 ± 22.3	117 ± 64.6	119 ± 59.5	6. 98/.003*
Paco2	40 ± 7.6	37 ± 9.0	36 ± 7.3	13.66/.000**
Sao2	88 ± 6.8	94 ± 6.4	94 ± 6.3	12.41/.000**

Table (3): Differences in glasgow coma scale of the studied subjects during the five assessments (n= 39)

Variable	X± SD	t value	p value
Initial GCS	8.3 ± 3.58	.248	.806
GCS pre supine position	8.4 ± 3.77		
Initial GCS	8.3 ± 3.58	.248	.806
GCS 15 minutes post supine position	8.4 ± 3.77		
Initial GCS	8.3 ± 3.58	.248	.806
GCS pre semi-fowler position	8.4 ± 3.77		
Initial GCS	8.3 ± 3.58	.248	.806
GCS 15 minutes post semi-fowler position	8.4 ± 3.77		

GCS: Glasgow coma scale