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EFFECT OF SUPINE VERSUS SEMI-FOWLER'S POSITIONS ON HEMODYNAMIC STABILITY OF PATIENTS WITH HEAD INJURY

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ABSTRACT

Objective: Traumatic brain injury is challenging practice for neurosurgical nurses. Intracranial hypertension is generally recognized to be the primary cause of death in patients with head injury and intracranial hemorrhage. Patient positioning has a profound effect on hemodynamic stability of head injured patients. The current study aimed to determine the effect of supine versus semi-fowler's positions on hemodynamic stability of patients with head injury. **Methods:** Fifty adult patients, diagnosed as head injury were included on in a quasi-experimental randomized clinical trial, over a period of 8 months, and were equally assigned into two groups. Group I was positioned on semi-fowler's position 30 for two hours. Group II was positioned on supine position for two hours. Quantitative hemodynamic "temperature, pulse, respiration, blood pressure, pulse pressure, and level of consciousness using Glasgow coma scale (GCS)" were monitored before and after positioning patients for both groups. **Results**: proved that group I had experienced improvement of hemodynamic parameters, as systolic blood pressure returned to normal range, pulse pressure decreased to normal compared to widening state before positioning, patient's level of consciousness had improved as measured by GCS, and diastolic blood pressure maintained within normal. no changes in temperature, pulse, and respiration for both groups. **Conclusion**: semi-fowler's position was more effective than supine position in hemodynamic stability of patients with head injury.

KEYWORDS: Traumatic brain injury, Fowler's position, Glasgow comma scale, Supine position, Blood pressure, intracranial pressure and cerebral perfusion pressure.

INTRODUCTION

Traumatic brain injury is a substantial cause of morbidity and mortality in the UK. An estimated 11.000 people per year sustain a severe traumatic brain injury, mostly between ages of 15 and 29 years.[1] Patients with severe traumatic brain injury have a high mortality rate 30-50% and many survivors will have persistent severe neurological disability.[2] Prompt identification and appropriate early management of traumatic brain injury is essential to optimize outcome.[3]

Intracranial hypertension is generally recognized to be the primary cause of death in patients with head injury and intracranial hemorrhage.[4] According to the American Association of Neurosurgical Surgeons (1996),[5] traumatic coma data bank (T.C.D.B) revealed that following aggressive pharmacological management protocols for I.C.P control had resulted in an overall mortality reduction from 50% to 36%.[6]

In 2001 Juulet al, studied the correlation between intracranial pressure (ICP) and neurological deterioration in patients with head injury. The results indicated that the most powerful predictor of neurological worsening and the major risk factor for neurological deterioration was the presence of intracranial hypertension (ICH). In addition, they found that the effect of increased ICP is dramatic and clearly translated into worse patient's outcome. This was manifested by the increase in both morbidity and mortality rates. Mortality rates were 93% in patients with increased ICP opposed to 46% in patients without ICP elevation. Moreover, the study recommended that in such patients, the emphasis should be on vigorous management of raised ICP.[7]

Increased ICP expose patients to life threatening and devastating complications. It does not directly affect neuronal activity; its main consequence is compromised cerebral blood flow, leading to cerebral ischemia and infarction.

Moreover the development of pressure gradients between the intracranial compartments resulting in brain herniation, which causes hemorrhagic necrosis, direct vascular injury, compression of vital structures (brain stem) and death. These complications can develop over hours or minutes, depending on the pathologic process.[8]

Previous researches have consistently shown that routine nursing care activities, including positioning, have a significant effect on ICP and consequently on hemodynamic stability

of patients with head injury. It could cause dramatic elevation of ICP which could be dangerous for patients with head injury.[9,10]

Caring for a patient with head injury requires an astute bedside nurse that plays a vital role. Intracranial Hypertension (ICH) among head injured patients can often lead to permanent neurologic injury if gone unrecognized. Prompt recognition of neurologic decline by the bedside nurse and timely diagnosis and intervention improves patient outcome and subsequent quality of life.[11]

An understanding of normal cerebral auto-regulation and its response to pathological derangements is helpful in the diagnosis, monitoring, management, and prognosis of severe traumatic brain injury (TBI). Pressure auto-regulation is the most common approach in testing the effects of mean arterial blood pressure on cerebral blood flow. A gold standard for measuring cerebral pressure auto-regulation is not available, and the literature shows considerable disparity in methods. This fact is not surprising given that cerebral auto-regulation is more a concept than a physically measurable entity. Alterations in cerebral auto-regulation can vary from patient to patient and over time and are critical during the first 4–5 days after injury. An assessment of cerebral auto-regulation as part of bedside neuromonitoring in the neurointensive care unit can allow the individualized treatment of secondary injury in a patient with severe traumatic head injury.[12]

The traditional practice of elevating the head in order to lower intracranial pressure (ICP) in head-injured patients has been challenged in recent years. Some investigators argue that patients with intracranial hypertension should be placed in a horizontal position, the rationale being that this will increase the cerebral perfusion pressure (CPP) and thereby improve cerebral blood flow (CBF). However, ICP is generally significantly higher when the patient is in the horizontal position. This study was undertaken to clarify the issue of optimal head position in the care of head-injured patients.[13]

So, caring for patients experiencing traumatic head injury is among the most challenging in neurosurgical nursing practice. A variety of researches proved that the way in which the patient positioned may prevent excessive changes in ICP and CPP, mainly for patients with traumatic head injuries. Therefore, this study *aims* to determine the effect of supine versus semi-fowler's positioning on hemodynamic stability of patients with head injured, which is very important for nursing practice.[14]

METHODES

A quasi-experimental randomized clinical trial was carried out at the Neuro-Surgical unit, Intensive Care Unit, and the Emergency Room of King Khalid Hospital, Majmaa, Kingdom of Saudi Arabia. Fifty adult patients, diagnosed as head injury were included on the study over a period of 8 months.

Inclusion criteria were patient aged from twenty to sixty years old, diagnosed as head injury, manifesting with intracranial hypertension, and free from cardiovascular diseases. ***Exclusion criteria*** were patients with previous history of chronic debilitating diseases as diabetes, hypertension, cardiopulmonary disorders, or ophthalmic disease.

After obtaining the official permission to carry out the study, patients were randomly assigned to two equal study groups, twenty five patients each. Group I was positioned on semi-fowler's position 30 for two hours. Group II was positioned on supine position for two hours. Quantitative hemodynamic "temperature, pulse, respiration, blood pressure, pulse pressure, and level of consciousness using GCS" were monitored before and after positioning patients for both groups. Patient’s consent for participation in the study was obtained from each patient and from a family member if the patient suffered from altered level of consciousness.

The data collected form each patient using "Hemodynamic assessment sheet" that was developed by researchers and tested statistically for validity and reliability. It consisted of two main parts; the first part used to record basic information regarding the patient's socio-demographic and clinical data such as age, sex, diagnosis, medication prescribed. The second part used to record variable data (hemodynamic parameters) including; temperature, pulse, respiration, blood pressure, pulse pressure, and level of consciousness (using Glasgow Coma Scale GCS).

Effect of supine versus semi-fowler's position was monitored against hemodynamic parameters of patients. The collected data were coded and statistically analyzed using numbers, percentage, arithmetic mean, and standard deviation. Descriptive statistics were used to report patient characteristics. The t- test was used to study associations between the both positions and the changes in the quantitative hemodynamic measurements.

RESULTS

Regarding frequency distribution of socio demographic and clinical characteristics of the studied patients, about age, it was found that more than half of patients were in the age group of eighteen to more years old while 44% of the studied patients were in the age group of forty years old or more.

Concerning sex, more than three quarters of the studied patients were males, while females constituted only 16% of the total studied patients. Regarding their level of education, more than half of the patients were able to read and write only. More than one quarter of the studied patients was illiterate. While only 2.2% of the studied patient obtained secondary level of education. Among the studied patients, more than one quarter were farmers, and nearly one fifth of them were housewives.

Table (I): Frequency distribution of socio-demographic and clinical characteristics of the studied patients.

	Socio-demographic and clinical variables	No.	%
A	1- Age:		
	☐ 18-39	33	66.0
	☐ 40-59	17	44.0
	Total	*50*	*100*
B	2- Sex:		
	☐ Female	8	16.0
	☐ Male	42	84.0
	Total	*50*	*100*
C	3- Level of education:		
	☐ Illiterate	19	38.0
	☐ Read and write	27	54.0
	☐ Primary education	3	6.0
	☐ Secondary education	1	2.2
	Total	*50*	*100*
D	4- Occupation:		
	☐ Farmer	15	30.0
	☐ House wife	8	16.0
	☐ Clerical work	13	26.0
	☐ Manual work	14	28.0
	Total	*50*	*100*

Concerning the effect of effect of supine versus fowler's position on hemodynamic of head injured patients, the mean value of systolic blood pressure (SBP) varied with position changes. Before positioning the patients in supine, the mean value of SBP was 124.6±17.0 mmHg, after two hours in supine position the mean value of SBP changed to 152.1±28.6 mmHg. As regards fowler's position (30^0), the mean value of SBP before positioning was 148.6±18.1 mmHg, It changed to be 125.8±11.8 mmHg two hours later.

As for the diastolic blood pressure (DBP), the mean value of DBP before positioning supine 90.0±11.9 mmHg, and remained the same without any changes after. While before fowler's position (30^0) it was 89.7±11.0 mmHg and changed to 89.3±10.5 mmHg.

Regarding the mean value of pulse pressure (PP) before supine positioning was 39.6±8.0 mmHg, it changed to 59.3±14.6 mmHg following it. The mean value of PP before fowler's position (30^0) was 62.0±12.4 mmHg, became 34.9±9.7 mmHg after two hours.

Table (II) presents mean, standard deviation, and (t) value of the effect of supine versus fowler's position on systolic, diastolic blood pressure, pulse pressure, and Glasgow Coma Scale

	Supine					Fowler's				
Parameter	Before		After		t-value	Before		After		t-value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Systolic blood Pressure	124.6	17.0	152.1	28.6	16.7*	148.6	18.1	125.8	11.8	16.3*
Diastolic Blood Pressure	90.0	11.9	90.0	11.9	-	89.7	11.0	89.3	10.5	1.8
Pulse pressure	39.6	8.0	59.3	14.6	19.8*	62.0	12.4	34.9	9.7	19.7*
Glasgow Coma Scale	11.6	1.2	11.6	1.2	-	11.6	1.2	12.8	1.4	3.7*
Temperature	36.4	0.9	36.4	0.9	-	36.5	0.9	36.5	0.9	-
Respiration	22.1	2.3	22.1	2.3	-	23	3.4	23	3.4	-
Pulse	98.2	12.1	98.2	12.1	-	95.6	10.2	95.6	10.2	-

It is obvious that the mean value of G.C.S score was 11.6±1.2 before positioning in supine and fowler's position (30^0). It remained the same without any change (11.6±1.2) following supine positioning. But after the patient's positioning in fowler's position (30^0) for two hours, the mean values of G.C.S score increased to 12.8±1.4. This change is statistically highly significant.

As for the mean value of the temperature, pulse, and respiration there was no significant change following neither supine nor semi-fowler's position (30^0).

DISCUSSION

Neurological complications often revolve around increased intracranial pressure (ICP), which can occur suddenly. Increased intracranial pressure or intracranial hypertension (ICH) is the most common life-threatening complications affecting individuals with head injury. The nursing management of patients with head injury suffering from increased intracranial pressure is a complex web of intermingled priorities. The neurosurgical nurse's role is vital in monitoring the patients' conditions, assessing their needs,

preventing complications and communicating their findings to the medical team. In order for nurses to make prompt decisions, it is important for them to be confident in caring for neurological patients.[15, 16]

Patient's positioning plays an important role in managing intracranial hypertension, analysis of present study findings revealed that putting patients in **semi-fowler's position** with head elevated 30 degree for those with head injury had affected them. It showed significant decrease in their mean value of systolic blood pressure, decrease in the mean value of diastolic blood pressure and significant lowering in the mean value of pulse pressure to normal range, significantly increased the G.C.S score of semi-conscious patients.

On the other hand, results of the present study revealed that positioning the patient with increased intracranial pressure in **supine position** had contributed to significant systolic hypertension, significant widening of pulse pressure. Such findings were similar to that of Abd El Hamid (2003)[17] who concluded that semi-fowler's position enhanced the arterial oxygenation, reduced the elevated.

ICP, and improved the level of consciousness in her study. She added that supine position is not a physiologic position for patients with ICH. Moreover, Durward*et al* (1983)[18] and, Kenning *et al* (1991)[19] reported that a marked diminution in ICP was observed in patients who assumed semi-setting position. Moreover, Moraine *et al* (2000)[20] and, Fisher (1997)[21] pointed out that elevating the head of the bed 30 degrees had created a hydrostatic pressure between the intracranial sinuses that drained the cranial vault into the right atrium. Similarly, Klein (1999)[22] observed that when the head of the bed was elevated 30 degrees it reduced the ICP by reducing jugular and cerebral venous pressure and enhancing venous outflow. Wong (2000)[23] and Rosver*et al* (1986)[24] proved that the reduction of cerebral perfusion pressure (CPP) occurred with head elevation. Although, Ng *et al* (2004)[25] concluded that nursing the patients with ICH at 30 degree-head elevation of the bed had led to a consistent reduction of ICP, and improvement in CPP but stated that it was without concomitant deleterious changes in cerebral oxygenation. Feldman *et al* (1992)[26] had also concluded that head elevation 30 degree significantly reduced the ICP without reducing CPP, or CBF. Furthermore, Winkelman (2000)[27] suggested that head elevation is beneficial and does not compromise cerebral perfusion. In this context, Stephan *et al* (2002),[28] and Fan (2004)[29] found that head elevation to 30

degrees had reduced the ICP without significantly lowering CPP, cerebral blood flow(CBF), or cardiac output. Moreover, Meixenburger*et al* (1997),[30] and Schneider *et al* (1993)[31] proved that head elevation did not adversely jeopardize cerebral microcirculatory oxygenation and was with no effect on global cerebral oxygenation. Moreover, March *et al* (1990)[32] and Simmons (1997)[33] found that head elevation should be individually assigned after analysis of response of the ICP and CPP in that position. Whereas in the other side Hobdell (1989)[34] found that there is no significant difference in the mean ICP following patient's positioning in supine position.

CONCLUSION AND RECOMMENDATIONS

From the foregoing results it can be concluded that semi-fowler's position was more effective than supine position on hemodynamic stability of patients with head injury. Neurological nurses should never forget that their patient is unique person, so they should keep head injured patients in semi-fowler's position with head elevation 30 degree, to facilitate venous drainage and lower ICP. Moreover, positioning patients with ICH in supine position should be avoided.

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Conflict of Interest

The Authors declare that they have no conflict of interest.

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