

MANAGEMENT INCREASED INTRACRANIAL PRESSURE IN PATIENTS WITH STROKE AND BRAIN TUMOR

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ABSTRACT

Management increased intracranial pressure (IICP) in stroke and brain tumor patients consists of pharmacotherapy and non-pharmacotherapy. Pharmacotherapy intervention comprises hyperosmolar therapy, euglycemia, hyperventilation and normocapnia, optimal oxygenation, controlling cerebral metabolism (sedation), anticonvulsant prophylaxis, and maintenance of normothermia. Furthermore, non-pharmacotherapy consist of positioning of head on bed position 15-30 degrees, initial trauma assessment (airway, breathing, and circulation), suctioning, control fluid and electrolytes, and nutrition need. The design of study was descriptive explorative for three patients in Songkla Nagarind Hospital, Hatyai, Thailand. The aim of the study was to describe management increased intracranial pressure in patients with stroke and brain tumor patients by using three questionnaires that consisted of Demographic Data Questionnaire (DDQ), Management of IICP Questionnaire (MIQ), and Glasgow Coma Scale (GCS). Data collection was conducted for three patients hospitalized with stroke (1 case) and brain tumor (2 cases). The study was analyzed by using descriptive statistic with mean (\bar{x}) and standard deviation (SD). The results of the study showed that management of IICP in those patients was good, and the Glasgow Coma scale (GCS) was delirious (1 case) and consciousness (2 cases). The study recommended that to caring the patients with IICP, the nurses must monitor for Cushing triad (hypertension, bradycardia, and bradypnea), vital signs, neurological signs, risk for ischemia cerebral, potential hyperthermia, fluid imbalance, and pain post surgical incision (craniotomy and V/P shunt) particularly for brain tumor patients and hydrocephalus.

Keywords: knowledge, abortus, related factors of abortus

INTRODUCTION

Hemorrhagic stroke results from rupture of intracranial blood vessels (Smith, Rosand, & Greenberg, 2005). About 50% of arteriovenous malformation (AVM) present with subarachnoid, intracerebral, or both types of bleeding. These can also be associated with a seizure disorder, headache, or focal neurologic deficit and increased intracranial pressure (IICP) (Kelley, 2006). Hemorrhagic stroke cause cerebral edema and can damage the hypothalamus, triggering hyperthermia and may cause life threatening. This leads to more vasodilatation, increased metabolic rate, and increased oxygen requirements (Polinsky & Muck, 2007).

Patients with brain tumors may also cause IICP. Mechanisms that regulate intracranial pressure in the closed skull mainly displacement of cerebrospinal fluid and intracranial blood volume become overwhelm and the patient develops progressive headache, nausea vomiting, drowsiness, and visual abnormalities

papillaedema on fundoscopy or diplopia due to abducens-nerve palsy (Behin, Hoang-Xuan, Carpentier, & Delattre, 2003). The symptoms of brain tumor include headache, seizures, fatigue, focal deficits, and cognitive disorders. Headaches associated with increased intracranial pressure (IICP).

These headaches were more severe, were associated with nausea or vomiting, and were resistant to analgesics. Brain tumors also produce an irritation in the brain that can cause abnormal electrical discharges. These abnormal electrical discharges can cause seizures (Lovely, 2004).

Early signs of IICP are headache and deteriorate level of consciousness. Several complication such as breathing and the airway problems, decreased life span, difficulty communicating, permanent loss of brain functions and movement or sensation (Change, 2009). Moreover, patients may develop altered in midline shift that show dilated or unreactive pupils, asymmetric pupils, extensor posturing, or progressive

neurologic deterioration, decrease in the Glasgow Coma Scale (GCS) score (Juul, Duch, & Rasmussen, 2009).

Prompt recognition and aggressive management of complication may prevent permanent neurological dysfunction or death by the interdisciplinary (Ignatavicius & Workman, 2006).

Management increased intracranial pressure has to be established into pharmacotherapy and non-pharmacotherapy approaches. Pharmacotherapy intervention comprises hyperosmolar therapy, euglycemia, hyperventilation and normocapnia, optimal oxygenation, controlling cerebral metabolism (sedation), barbiturate coma, anticonvulsant prophylaxis, maintenance of normothermia, and coagulation therapy.

Furthermore, non-pharmacotherapy consist of positioning, initial trauma assessment (airway, breathing, and circulation), suctioning, and control fluid, electrolytes and nutrition (Goh & Gupta, 2002; Palmer, 2000).

The nurses should have sufficient knowledge and skills to support ventilation and deal with oxygenation problems (airway obstruction, increased PaCO₂, and hypoxemia), positioning (head on the bed 15-30 degree), reduce increased metabolic rate, reduce stressors (pain, disturbing conversation, noise, and bright lights), and others such as avoiding Valsalva maneuver, coughing, and vomiting. Furthermore, the nurses have to establish a baseline neurologic assessment, patients' electrolytes, oxygen saturation, and carbon dioxide levels (Lejeune & Howard, 2002).

The nurses also should monitor cerebral tissue perfusion, fluid volume, breathing pattern, body temperature, risk infection, injury, and altered nutrition (Hudak, Gallo, & Morton, 1998).

Initial and promptly nursing assessment and early aggressive resuscitation of critically ill patients may prolong life. Therefore, the nurses should have sufficient knowledge and skills regarding management increased intracranial pressure in stroke and brain tumor patients to decrease morbidity and mortality.

Objectives of the study

1) To identify level of management increased intracranial pressure (IICP) in stroke and brain tumor patients. 2) To determine factor related to IICP in stroke and brain tumor patients. 3) To implement nursing intervention for IICP in stroke and brain tumor patients. 4) To apply measurement tools for management of IICP in stroke and brain tumor patients

Assessment Tools

Preventing of IICP in hemorrhagic stroke and brain tumor patients was assessed by using 3 assessment tools, are as follows:

Demographic Data Questionnaire (DDQ)

Measurement tool were developed by the researcher, which consist of 6 items: age, gender, current job, medical diagnosis, cause of associated to IICP, and signs and symptoms of IICP.

Management of IICP Questionnaire (MIQ)

Measurement tool were developed by the researcher. The questionnaire consists of 20 items relating to management of IICP in hemorrhagic stroke and brain tumor patients. The instrument were responded with scoring 1 (abnormal values) and 2 (normal values). Score for each item were summed by giving a score range from 20 to 40. Interpretation of the result study was categorized into three levels, fair: 20-26, moderate: 27-33, and good: 34-40, with the higher score reflects the good management of IICP.

Glasgow Coma Scale (GCS)

The measurement consist of 8 items: eye open, verbal response, motor response, pupil diameter guide and reaction, blood pressure, pulse, respiration, and limb movement (arm and legs). **a)** GCS score consist of eye open (E), verbal response (V), motor response (M). Score for each item were summed by giving a score range from 3 to 15. Interpretation of the result study were used scoring for level consciousness: 13-15 (minor brain lesion), delirious: 9-12 (moderate brain lesion), and comatose (severe brain lesion): ≤ 8 . **b)** Pupil size: 1 to 8 mm, and reaction to light, **c)** Score for each item

were summed by giving a score range from 1 to 8 mm. Interpretation of the result study will use scoring, normal: 1-5 mm and reactive, and abnormal: > 5mm and non-reactive, **c)** Blood pressure, pulse, and respiration: **1)** Blood pressure were summed by giving a score range systolic blood pressure (SBP) and diastolic blood pressure (DBP) from 90/60 to 180/100 mmHg. Interpretation of the result study was scored, normal: 90/60-180/100 mmHg for brain lesion, and abnormal: <90/60 or >180/100 mmHg, **2)** Pulse were summed by giving a score range from 60-120 beat per minute (bpm). Interpretation of the result study was scored, normal: 60-120 bpm, and abnormal < 60 or >120 bpm, **3)** were summed by giving a score range from 14-24 breaths/minutes. Interpretation of the result study was scored, normal: 14-24 breaths/min, and abnormal <14 or > 24 breaths/min, **4)** Limb movement (arm and legs): Score for each item were summed by giving a score range from 1 to 6. Interpretation of the result study was scored, normal: 6, and abnormal < 6.

Methodology of study

1) The target patients were determined based on inclusion criteria: willing to participate in this study, and diagnosed for stroke or brain tumor. The researcher made patient's answer by putting mark (√) in the appropriate patients' condition, **2)** All of the questionnaires were evaluated for "day 1" and "day 3" for nursing intervention on preventing of IICP, **3)** Data was collected for day 1 and day 3 for nursing intervention and compared to identify the effectiveness of preventing of IICP in stroke and brain tumor patients.

RESULTS

Demographic data consist of age, gender, current job, medical diagnosis, cause associate of IICP, and signs and symptoms of IICP are showed as the following:

Table 1: Characteristic of Demographic Data of IICP in Stroke and Brain Tumor Patients

Age	Gender	Current job	Med. Diagnosis	Causes associate IICP	Signs and symptoms of IICP
69	M	Retired	Ischemic stroke	Increased intracranial volume related brain edema	Seizure, headache, and decrease consciousness
22	M	Business person	Brain tumor at pineal region + hydrocephalus	Obstruction/low absorption resulting in hydrocephalus	Headache, nausea, vomiting, and nystagmus
53	F	Gov. employee	Frontal lobe tumor, parasagittal meningioma	Increased intracranial volume related to tumor	Headache, behavior change, confuse

Results and Discussion

The result of the phenomena study will be explained based on three measurement tools for management of IICP in stroke and brain tumor patients consisting.

Demographic Data Questionnaire (DDQ).

Case 1: The patient had history underlying disease with hypertension for 3 years ago, diagnosed with ischemic stroke for past 8 months, right side paralyze, bedridden, and seizure triggered during hospitalized. During seizure trigger, patients showed that loss of consciousness, pupil dilated and non-reactive to light, irregular respiration, excessive salivation, bradycardia, and hypertension. According to Holloway (1999) seizure related to structural or physical condition such as IICP, cerebral edema, cerebral subdural hematoma, cerebral hemorrhage, and hypertension. However, for this case seizure related to cerebral edema, because computerized scanning of the brain showed that hypodense lesion and ventricle system dilatation without subarachnoid hemorrhage (SAH).

Cases 2: Patient had underlying tumor mass at pineal region of brain, developed hydrocephalus, brain edema, headache, nausea, vomiting, upward gaze palsy retraction nystagmus, and has not accommodation to light (Perinaul's syndrome). Patient has been done for craniotomy with VP shunt on September 1, 2009. Neurological sign showed that E4V5M6, pupil size left eye 4 mm, and right

eye 3 mm, both of them no responses to light. According to Lovely (2004) stated that the headache in patient with brain tumor caused by local traction on pain-sensitive intracranial structures. These structures include the large venous, arteries, veins, venous sinuses, cranial nerves, and portions of the duramater.

Cases 3: Patient diagnosed with lobe tumor parasagittal meningioma, developed hydrocephalus, and behavior changed. Patient had been done craniotomy with VP shunt on August 31, 2009. Neurological sign showed that E₄V₅M₆, pupil size left eye 3 mm, and right eye 3 mm, and both of them response to light.

Management of IICP Questionnaire (MIQ)

Management of IICP questionnaire consist of hyperosmolar therapy, glucose blood serum control, optimal oxygenation, controlling cerebral metabolism, anticonvulsant prophylaxis, maintenance of normothermia, laboratory data (Na⁺, K⁺, BUN, Creatinin, and Ca) and early signs and symptoms of Cushing triad. The result management of IICP in stroke and brain tumor patients was summed for 20 items by using range score, which fair: 20-26, moderate: 27-33, and good: 34-40.

Tables 2: Preventing of IICP in Stroke and Brain Tumor Patients

Cases	Day 1		Day 3	
	Scores	Levels	Scores	Levels
1	27	Moderate	38	Good
2	34	Good	36	Good
3	35	Good	37	Good

Table analysis: Based on the table 2 showed that distribution of management of IICP in stroke and brain tumor patients for day 1 and day 3 interventions are good level.

Case 1: For this patient, computerized topography (CT) of the brain showed has periventricular hypodense lesion and ventricle system dilatation without subarachnoid hemorrhage (SAH) in brain tissue, not showed cardiac dysfunction,

hence the patient no need to prescript for barbiturate therapy, dopamine therapy, and osmotic therapy (mannitol). Patient has score 1 (abnormal value) for day 1 intervention for each items for instance of intake and output fluid (920 and 200 mL for 8 hours), intracranial pressure (ICP) (showed seizure), PO₂ (187 mm Hg), PCO₂ (25.9 mmHg), and pH (7.47), and showed bradypnea. Moreover, for day 3, patient showed normal values in pH, no bradypnea, no seizure, but have not new data for PCO₂ and PO₂. The mean score of management of IICP in day 1 and day 3 nursing interventions was in good level, because of some items of the questionnaire showed the normal values for measuring management of IICP, leading to good score of management of IICP in stroke patient.

According to Holloway (1999) mention that nursing diagnosis in IICP patient consist of risk for cerebral ischemia, risk for infection, risk for increased cerebral metabolism, risk for respiratory failure, risk for fluid volume deficit or excess, and risk for injury. For case 1, nursing diagnosis focused on (1) risk for ineffective airways clearance related to increased oral and tracheal mucous secretion, (2) risk for cerebral ischemia related to hypoxemia or hypercapnia, and (3) risk for respiratory failure related to cerebral dysfunction, obstructed airway, and altered levels of consciousness. Particularly for case 1, risk for ineffective airways clearance developed because patient has increased with mouth and endotracheal secretion with white and brown colors. Clinical hematology showed white blood count (WBC) was 14.75×10^3 , also patient with continuous mechanical ventilator (CMV) for past 4 days and showed ineffective spontaneous and deep breathing.

Nursing intervention for IICP patient focused on maintain adequate airway clearance including clearing the mouth and oral pharynx secretion, suctioning the oropharynx and trachea every 1-2 hours, maintain humidified oxygen, endotracheal intubation, mechanical ventilation to maintain the patients' PaO₂ and PaCO₂. Maintaining patient in head on the bed

(HOB) position 15-30 degrees, monitoring for GCS score, respiratory status, oxygen saturation (O_2 Sat), Hemoglobin (Hb), $PaCO_2$, serum glucose level, and avoiding neck flexion/knee flexion. For this case was prescript for medical therapy such as Ranitidine 50 mg injection, Ceftriaxone IV 1 gram injection, Phenytoin injection 250 mg/5 ml, Trace EI 60 mL, Allupurinol 100 mg, Colchicine 0.6 mg tab, ASA 81 mg enteric, and Simvastatin 20 mg tablet.

According to Lovely (2004) stated that treatment of seizures is known as anti epileptics (Phenytoin, Carbamazepine, and Valproate) with the least side effects. Antiepileptic medications will provide protection against seizures. Moreover, nursing intervention in the study was in accordance to Ignatavicius and Workman (2006) stated that the objective nursing intervention for IICP patient focused on effective airway clearance, adequate positioning, improving level of consciousness (stable GCS and ICP less than 15 mm Hg), and intracranial pressure monitoring.

Case 2: The patient did not show SAH and brain hemorrhage of CT of the brain. The mean score of management IICP for day 1 and day 3 interventions is in good level, due to some items the questionnaire showed the normal values for measuring management of IICP. Some items of the questionnaire showed the normal values, leading to good level management of IICP in brain tumor patient. CT of the brain showed that patient had brain hydrocephalus with mass at pineal region tumor maker, no SAH, no brain edema, and no arrhythmia. During day 1 nursing intervention, patient had score 1 (abnormal values) for each items of blood pressure (150/90 mm Hg), hyperthermia ($38.3^{\circ}C$), and dry mouth mucous (inadequate fluid intake).

Moreover, nursing evaluation for day 3, patient showed normal value in body temperature ($37.8^{\circ}C$), blood pressure: 140/90 mm Hg, fluid intake/output was balance (1450/1400 mL), and monitored for Cushing triad signs (hypertension, bradycardia, and bradypnea). Josephson (2004) mention that injured brain is especially vulnerable to changes in body

temperature. Increased temperature causes an increase in cerebral metabolism and an increase in CBF and intracranial pressure. Patients who have acute neurological injury may have temperature fluctuations due to infection, sepsis, intracranial blood, and hypothalamic disturbances. Temperature greater than $37.5^{\circ}C$ is associated with increased intracranial pressure and increased cerebral metabolic rate of oxygen. Fever should be treated aggressively in patients, antipyretic should be given, and sponge bath and cooling blankets are all appropriate measures for reducing fever.

Nursing diagnosis focused on (1) risk for cerebral ischemia related to hypoxemia or hypercapnia, (2) risk for respiratory failure related to cerebral dysfunction, and (3) risk for fluid volume deficit related to fluid restriction or hyperthermia. Nursing intervention focused on maintain airway patient in HOB position 15-30 degrees, monitor GCS scores, monitor respiratory status, monitor O_2 sat, and Hb, maintain serum glucose level, and avoid neck flexion/knee flexion. On the other hand, patient also was maintain for fluid volume balance, control blood pressure, and medical therapy for instance Phenytoin injection 250 mg/5ml, Morphine 10 mg/ml injection, Cloxacillin 1 gm injection, Ranitidine 50 mg injection, and Dexamethason 8 mg/2 mL injection. Lovely (2004) stated that after diagnosis of the tumor, a patient may be prescribed a steroid, commonly Dexamethasone. Steroids help relieve headache by decreasing the pressure caused by edema from the brain tumor.

Case 3: The patient did not show SAH and brain hemorrhage. CT of the brain showed that patient has frontal lobe tumor, parasagittal meningioma and hydrocephalus, change behavior, confuse, cognitive deficit, headache, and talk active because prefrontal cortex disorder from mass effect. Taphoorn and Klein (2004) mentioned that deficits in cognitive function may be caused by cerebral cortical lesions or even from damage to cerebral structure.

During day 1 nursing intervention, patient had score 1 (abnormal values) for each items of PO_2 (165 mmHg), ICP (confuse), pH (7.46), and blood pressure

(150/90 mmHg). Moreover, for days 3 nursing intervention, patient showed normal value in blood pressure (140/80 mmHg), pH (7.38), and have not new data for PO₂. The mean score management of IICP for day 1 and day 3 nursing intervention is good level due to the items of them have normal values to measuring the IICP management, leading to a good score of management IICP in brain tumor and hydrocephalus patient.

Nursing diagnosis focused on (1) risk for cerebral ischemia related to hypoxemia or hypercapnia, and (2) risk for respiratory failure related to cerebral dysfunction, and altered levels of consciousness. Moreover, nursing intervention focused on maintain airway patient in HOB position 15-30 degrees, monitor GCS score, monitor respiratory status, monitor O₂sat, Hb, and PaCO₂, maintain serum glucose level, and avoid neck flexion/knee flexion. On the other hand, patient also was maintain for fluid volume balance, control blood pressure, and therapy for 0.9 % normal saline solution (NSS) 80 mL/hr, Morphine 10 mg/mL injection, Phenytoin 100 mg, Dexamethason 8 mg/2 mL injection, Serration peptidase 5 mg tablet, Ceftriaxone IV 1 gram injection, Clindamycin injection, and Heparin 100 (central vein injection).

According to Rowat (2001) found that the 30° propped up position has been shown to reduce significantly intracranial pressure without reducing cerebral blood flow and cerebral perfusion pressure in brain injured patients. On the other hand, morphine is frequently used to limit pain, facilitate mechanical ventilation, and potentiate the effect of sedation. Morphine do not increased cerebral brain fluid (CBF) and increased cranial pressure (Hudak et al., 1998).

Polinsky and Muck (2007) stated that hypertonic intravenous fluid (0.9% NSS, lactated ringers, and albumin) is usually used for patients with increased cerebral hemorrhage (ICH). Hypotonic solutions will increase the amount of edema.

Glasgow Coma Scale (GCS)

Case 1: GCS: E₃V₁M₄ → delirious: (moderate brain lesion), post ischemic

stroke, bedridden, left paralyze, and have CMV ventilator support, pupil size and reaction, normal: 1-5 mm and reactive, blood pressure pulse and respiration: blood pressure: normal, 90-170 mmHg for brain lesion, pulse: normal, 60-100 beat per minute (bpm), respiratory rate: normal, 14-30/min, limb movement: arm: abnormal with 4 score (severe weakness, and right side paralyze).

Cases 2: GCS: E₄V₅M₆ → consciousness: 13-15 (minor brain lesion), 1-day post operation craniotomy, and V/P shunt as indicated brain tumor and hydrocephalus. Pupil size and reaction, normal: 1-5 mm and reactive, blood pressure pulse and respiration: blood pressure: normal, 90-170 mmHg for brain lesion, pulse: normal, 60-100 bpm, respiratory rate: normal, 14-30/min, and limb movement: arm: normal with 5 score (normal power).

Cases 3: GCS: E₄V₅M₅ → consciousness 13-15 (minor brain lesion), 4 days post operation craniotomy, and V/P shunt as indicated brain tumor and hydrocephalus. Pupil size and reaction, normal: 1-5 mm and reactive, blood pressure pulse and respiration: blood pressure: normal, 90-170 mm Hg for brain lesion, pulse: normal, 60-100 bpm, respiratory rate: normal, 14-30/min, limb movement: arm: normal with 5 score (normal power).

CONCLUSION AND RECOMMENDATIONS

Summary of the Study

Early signs of increased intracranial pressure are headache, nausea, vomiting and deteriorate level of consciousness. Several complication of IICP such as breathing and the airway problems, decreased life span, difficulty communicating, permanent loss of brain functions and movement or sensation. Moreover, patients may develop altered in midline shift that show dilated or no reactive pupils, asymmetric pupils, extensor posturing, or progressive neurologic deterioration, and decrease in the Glasgow Coma Scale (GCS).

Prompt recognition and aggressive management of complication may prevent permanent neurological dysfunction or death by the interdisciplinary. Management

increased intracranial pressure must be established into pharmacotherapy and non-pharmacotherapy approach. The finding of management of IICP in stroke and brain tumor patients for pre and post nursing intervention are moderate levels. There are six items of measurement tool cannot be measured due to the items did not available in those cases, leading to moderate score of management of IICP.

Limitation of the study

The limitations of the patients IICP with hemorrhagic stroke, hence, the researcher conducted only for two cases of IICP patients with brain tumor and one case with stroke patient. Moreover, measurement tool of management of IICP is developed by the researcher based on the literature review, therefore need to test the validity's instruments for the next study. Lastly, some items measurement tool such as CPP, PaCO₂, PaO₂, barbiturate therapy, dopamine therapy, and osmotic therapy (mannitol) cannot be measured for management of IICP patients due to did not available for all cases, and all cases did not show with subarachnoid hypertropi (SAH) and brain hemorrhage.

Recommendations

The nurses should have sufficient knowledge and skills to support ventilation and deal with oxygenation problems such as airway obstruction, increased PaCO₂, and hypoxemia, maintain positioning of head on the bed 15-30 degrees, reduce increased metabolic rate, reduce stressors such as pain, disturbing conversation, noise, and bright lights, and others such as avoiding Valsalva maneuver, coughing, and vomiting. Furthermore, in caring IICP patients, the nurses have to establish a baseline neurologic assessment, patients' electrolytes, oxygen saturation, and carbon dioxide levels. The nurses also should monitor cerebral tissue perfusion, fluid volume, breathing pattern, body temperature, risk infection, injury, and altered nutrition.

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