THE DEVELOPMENT OF A CLINICAL NURSING PRACTICE GUIDELINE FOR PREVENTION OF HYPOXEMIA AND HYPOTENSION IN HEAD INJURED PATIENTS AT EMERGENCY ROOM

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Entitled

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ABSTRACT

At emergency rooms, hypoxemia and hypotension are significant causes of neurological deterioration that lead to mortality in head-injured patients.

For the development of a clinical nursing practice guideline (CNPG) for the prevention of hypoxemia and hypotension in head-injured patients at emergency rooms, an evidence-based practice model that had four phases was used. In this study phase I-III was developed. Phase I involved analyzing problems. It was found that hypoxemia and hypotension are significant causes of neurological deterioration in head-injured patients. Phase II involved researching and analyzing the evidence. A total of twenty studies, which were at levels I-VII, were included in the development of clinical nursing practice guidelines. The outcomes of synthesis in developing CNPG include 3 main issues such as assessment, nursing management and monitoring to prevent hypoxemia and hypotension for head-injured patients at emergency rooms by using the Advanced Trauma Life Support (ATLS®). Phase III involved content validation by seven experts in order to establish a CNPG with a clear context and consistency. For phase IV, the investigator plans to implement CNPG in Emergency unit.

The suggestions for implementing this CNPG to nursing practice were noted. To utilize the established CNPG, it is necessary to analyze the unit and training of CNPG for nurse. The practice guidelines should be carried out by a multidisciplinary team, and should be incorporated into outcome research.

KEY WORDS: HEAD INJURED PATIENT/ HYPOXEMIA/ HYPOTENSION/ CLINICAL NURSING PRACTICE GUIDELINE

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การพัฒนาแนวปฏิบัติการพยาบาลเพื่อป้องกันภาวะพร่องออกซิเจนและความดันโลหิตต่ำในผู้ป่วยบาดเจ็บที่ศีรษะในห้องอุบัติเหตุฉุกเฉิน

(THE DEVELOPMENT OF A CLINICAL NURSING PRACTICE GUIDELINE FOR PREVENTION OF HYPOXEMIA AND HYPOTENSION IN HEAD INJURED PATIENTS AT EMERGENCY ROOM)

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บทคัดย่อ

ภาวะพร่องออกซิเจนในเลือด และภาวะความดันโลหิตต่ำ เป็นปัญหาที่สำคัญของผู้ป่วยบาดเจ็บที่ศีรษะที่เข้ารับการรักษาในห้องอุบัติเหตุฉุกเฉิน ส่งผลให้การบาดเจ็บที่ศีรษะรุนแรงขึ้น ทำให้มีการเสียชีวิตของผู้ป่วยบาดเจ็บที่ศีรษะที่เข้ารับการรักษาในห้องอุบัติเหตุฉุกเฉิน

การพัฒนาแนวปฏิบัติการพยาบาลสำหรับการจัดการทางการพยาบาลเพื่อป้องกันภาวะพร่องออกซิเจนและความดันโลหิตต่ำในผู้ป่วยบาดเจ็บที่ศีรษะในห้องอุบัติเหตุฉุกเฉินนี้ ใช้ Evidence-based practice model ทั้ง 4 ระยะเป็นรูปแบบในการพัฒนา โดยใช้เฉพาะกระบวนการตั้งแต่ระยะที่ 1-3 ดังนี้ ระยะที่ 1 เป็นการวิเคราะห์ปัญหา พบว่าภาวะพร่องออกซิเจนและภาวะความดันโลหิตต่ำเป็นปัญหาทางคลินิกที่สำคัญของผู้ป่วยบาดเจ็บที่ศีรษะในห้องอุบัติเหตุฉุกเฉิน ระยะที่ 2 เป็นการสืบค้นและวิเคราะห์หลักฐานเชิงประจักษ์ ได้ทั้งหมดจำนวน 20 เรื่อง เป็นหลักฐานเชิงประจักษ์อยู่ระหว่างระดับ 1-7 นำมาวิเคราะห์สังเคราะห์และประเมินคุณภาพงานวิจัยก่อนนำมาพัฒนาเป็นแนวปฏิบัติทางการพยาบาล ข้อสรุปจากหลักฐานเชิงประจักษ์แบ่งเป็น 3 ประเด็น คือ การประเมินอาการผู้ป่วย การจัดการทางการพยาบาล และการเฝ้าระวังติดตามอย่างต่อเนื่อง โดยการใช้หลักการตามแนวทางของ ATLS® และได้นำข้อสรุปดังกล่าวมาพัฒนาเป็นแนวปฏิบัติการพยาบาลในการป้องกันภาวะพร่องออกซิเจนและความดันโลหิตต่ำ ระยะที่ 3 เป็นการนำแนวปฏิบัติที่สร้างขึ้นไปให้ผู้ทรงคุณวุฒิ 7 ท่านตรวจสอบ พบว่าเนื้อหามีความชัดเจนไม่ซ้ำซ้อนและให้เพิ่มเติมในส่วนของความชัดเจนของภาษา และได้ปรับปรุงแก้ไขแนวปฏิบัติตามข้อเสนอแนะ ระยะที่ 4 วางแผนนำแนวปฏิบัติไปทดลองใช้จริงในหน่วยงาน

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66 หน้า

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CHAPTER I
INTRODUCTION

Background and Significance of the Study

Head injured patients who were treated at emergency room (ER) had mild head injury around 80%, moderate head injury around 10%, and around 10% had severe head injury (American College of Surgeons Committee on Trauma (ACS), 2004; Biros & Heegaard, 2001; Statistics of ER, Phrae Hospital, 2006). Head injury includes injuries of scalp laceration, skull, brain and cerebrovascular (Hickey, 2003; Marik, Varon, & Trask, 2002; Rattanalert, 2003) that leads to have hypoxemia and hypotension (Critchley, 2004; Manley et al., 2001; Marik et al., 2002; Rattanalert, 2003). Mortality rate of patients with hypoxemia and hypotension who were treated at emergency room was 57% and without hypoxemia and hypotension was 27% (Piengkaew & Peounphathom, 2002). Head injured patients in resuscitation period who were treated at emergency room had hypoxemia as 14% and hypotension as 41% that were the causes of increased mortality rate (Manley et al., 2001) but those depended on the severity of head injury (Myburg, 2003). The initial assessment on head injury and management at emergency room were quite essential (Finfer & Cohen, 2001; Howard, 2003) because the changes on head injury condition depended on pathology or brain damage. Appropriate proper assessment and initial management for the head injured patients who were treated at emergency room help saving the patient's lives (McQuillan & Mitchell, 2002).

Hypoxemia and hypotension are significant causes of neurological deterioration in head injured patients who were treated at emergency room. Head injured patients who are hypoxemia can transform direct head injury that leads to have abnormal pattern breathing from neurogenic pulmonary dysfunction (McQuillan & Mitchell, 2002) which generated respiratory failure or apnea (Peounphathom, 2001; Rattanalert, 2003) and airway obstruction. Head injured patients are at increased risk of aspiration and airway obstruction from the patient's upper airway relaxes and

tongue could prolepses back, (McQuillan & Mitchell, 2002) , from blood, vomitus, or other debris in their oropharynx (Biros & Heegaard, 2001). Other additional physical conditions that cause insufficient breathing, which is hypoxemia are flail chest, hemopneumothorax, injury of upper respiratory function and unconsciousness (Stuke, Arrastia, Gentilello, & Shafi, 2007). The mentioned causes and pathology of brain damage can cause the decrease of cerebral perfusion pressure (CPP), brain ischemia by insufficient blood and oxygen supply and neurogenic dysfunction (Hickey, 2003; Manley et al., 2001). Hypotension is occurred by blood loss from severe scalp laceration (Turnage & Mauli, 2000) and bleeding from other organs injury (Kirby & Menon, 2005). Blood loss offers the decreased intravascular volume that generates the reduction of blood supply to brain (Manley et al., 2001). Hypoxemia and more brain damage cause irreversible change and non-response to treatment of the patients (Vincent & Berre, 2005). Prevention and immediate proper response to hypoxemia and hypotension combining with bleeding control for the patients with head injury at emergency room will assist less brain damage and more feasible reversible brain function but it depends on the size, location and blood supply to brain tissue (McQuillan & Mitchell, 2002; Thisavipath, 2000).

The goals of care for the patients with head injury who are treated at emergency room are to keep cerebral hemodynamic and prevent hypoxemia and hypotension by assessing breathing and protecting cervical spines (Biros & Heegaard, 2001; Finfer & Cohen, 2001; Kirby & Menon, 2005; Marik et al., 2002) including monitoring respiratory tract and breathing with oxygen saturation $\leq$ 95% (Finfer & Cohen, 2001; Palmer et al., 2001). Head injured patients with glasgow coma scale less than 8 have to be intubated for sufficient oxygenation (Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2005; Palmer et al., 2001; Vincent & Berre, 2005). They had to have systolic blood pressure (SBP) over 90 mmHg and mean arterial blood pressure (MAP) over 90 mmHg to maintain sufficiency of blood supply to brain (Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2005; Palmer et al., 2001; Vincent & Berre, 2005). Neurological assessment, history gathering to verify other risk factors for instance, mechanism of injury, pre-hospital care, age, gender, severity of the injury, underlying diseases and blood alcohol or antidepressant level (Biros & Heegaard, 2001; Critchley, 2004; Hickey, 2003; Myburg, 2003) that

save the head injured patients and reduce the harmful of patients' lives (Sperry et al., 2006; Stuke et al., 2007).

From the working experience in nursing care for head injured patients who were treated at emergency room of Siriraj Hospital and Phrae Hospital, the nursing care for the head injured patients at emergency room were no prioritization, incomplete monitoring and no clinical nursing practice guideline that might cause hypoxemia from airway obstruction and hypotension from massive blood loss. Thus the indicators on patients with severe head injury was increased as 0.3% in 2005 and 0.2 in 2006 (Statistic of ER indicator, Phrae Hospital, 2006) that is from inadequate neurological assessment and continuous monitoring on respiratory tract and general condition and may cause the delayed management for head injured patients. It is opposite from the principles of care for patients with head injury which include the constant monitoring and document every 15 minutes with vital signs, abnormal signs and symptoms (Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2005; Palmer et al., 2001; Vincent & Berre, 2005), neurological signs, conscious level, those parameters had change immediately notify to neurosurgeon for proper management (Biros & Heegaard, 2001; Marik et al., 2002), and blood gas analysis in intubated head injured patients (Cranshaw & Nolan, 2006; Kirby & Menon, 2006).

Current nursing care of head injured patients who were treated at emergency room contains several practices (Finfer & Cohen, 2001; Imhof & Lenzlinger, 2005; Moppett, 2007) even if Advance Trauma Life Support (ATLS®) is applied as a managerial principle (Biros & Heegaard, 2001; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2006; Price, Suttner & Aspoas, 2003). There are varieties of care, especially for the patients with mild head injury (Fabbri et al., 2004a; Vos et al., 2002). Due to the evidence of mild head injury, the patients usually did not receive immediate care and assessment (McQuillan & Mitchell, 2002, Muller et al., 2003) that may cause insufficient oxygen supply to brain from undetectable cerebral hemorrhage. The delayed management may increase severity of head injury and harmful of the patient's lives (Ingebrigtsen, Romner, & Kock-Jensen, 2000; Fabbri et al., 2004a).

The investigator is interested in the development of nursing practice guideline for head injured patients who are treated at emergency room by applying the evidence-based practice model of Soukup (2000) that includes problem analysis and systemic

research synthesis. It will assist establishing the science-based nursing practice guideline which carries the reliability and standard (Tilokskulchai, 2006). The head injured patients who are treated at emergency room will receive initial assessment, nursing management, constant monitoring and coordination with multidisciplinary approach to reduce probable harm that will increase efficacy of care for head injured patients leading to have the development on nursing practice guideline on that matter.

Main Issues

Hypoxemia and hypotension are significant causes of neurological deterioration in head injured patients who are treated at emergency room (Critchley, 2004; Manley et al., 2001; Marik et al., 2002) because direct brain injury, airway obstruction and other physical conditions of insufficient breathing and blood loss from cerebral hemorrhage or other organs injury. Those generate the decreased cerebral perfusion pressure, and imbalance of brain functions that increase severity of brain damage. Initial assessment, nursing management and monitoring are obvious concepts for prevention to hypoxemia and hypotension in head injured patients and will assist in saving patient's lives.

Purposes of the Study

To develop the clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room.

Expected Outcomes

1. To have the standard nursing practice guideline for head injured patients who are treated at emergency room.
2. To develop quality of nursing care for head injured patients who are treated at emergency room.
3. To increase the patient's safety from hypoxemia and hypotension and reduce mortality rate of head injured patients who are treated at emergency room.

CHAPTER II
LITERATURE REVIEW

Review of Existing Literature Related to Issues of Concern

This thematic paper aims to conduct the development of a clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room with the relevant documents and researches as follows:

1. Head injury of the patients at emergency room
    - 1.1 Mechanism and characteristics of head injury
    - 1.2 Severity of head injury
    - 1.3 Pathophysiology of head injury
2. Concept of clinical nursing practice and management for head injured patients at emergency room
    - 2.1 Concept of clinical nursing practice for head injured patients at emergency room
    - 2.2 Nursing management for head injured patients at emergency room
3. Development of a clinical nursing practice guideline
    - 3.1 Model of the development on a clinical nursing practice guideline
    - 3.2 Development of a clinical nursing practice guideline according to empirical evidence-based parallel

Conceptual Framework of the Study

1. Head injury of the patients at emergency room

Head injured patients who are treated at emergency room within two hours. Head injured-patients are defined as the patients who have head injury by direct force to the head that cause injury to scalp, skull, brain and cerebrovascular (Hickey, 2003; Neurosurgery Association of Thailand and Surgical College of Thailand, 1997). The causes of head injury include car accident and motorcycle accident as 50% (Biros & Heegaard, 2001; Hickey, 2003; Public Health News, 2000), fall as 21% found in the elderly and children (Howard, 2003; Public Health News, 2000), violence and assaults as 12%, and sport accident as 10% (Public Health News, 2000). Significant characteristics of head injury are as follows:

1.1 Mechanism and characteristics of head injury

Mechanism of head injury of the patient at emergency room mostly is not from one direct force but it is from multiple direct forces. There are two main categories of head injury mechanism according to the character of skull after received the direct attack (Hickey, 2003) which are contact phenomena injury and acceleration-deceleration injuries. Mechanism of contact phenomena injury causes injury or pathology to coup lesion, most likely with skull fracture. Cerebral hemorrhage and brain contusion may be occurred in contra coup lesion. Mechanism of this contact phenomena injury depends on size of the attack area, duration and direction of the attack (Vos et al., 2002). Brain injury is from intracranial strain, which includes compression strain and shearing strain that depends on duration and severity of the attack force. If prolonged attack to brain is occurred, the strain will be extended to either vertical or horizontal direction that cause concussion and diffuse axonal injury (Hickey, 2003). If short attack to brain is happened, focal brain injury will be found and also depends on type of acceleration between brain and skull. There are 3 types of acceleration as angular acceleration, translational acceleration, and rotational acceleration. Rotational acceleration is usually occurred with angular acceleration that generates severe head injury in any injured characteristics (Hickey, 2003). As the mechanism mentioned, head injured patients who are treated at emergency room carry two characteristics of head injury, which are focal injury and diffuse injury (Linsay, Bone, & Callander, 2004; Howard, 2003). Focal injury refers to head injury with scalp laceration and skull fracture. It is mostly found linear skull fracture, depressed

skull fracture and basilar skull fracture that have the signs and symptoms of periorbital ecchymosis (raccoon eyes), retroauricular ecchymosis (battle's sign) and CSF leakage from the nose (rhinorrhea) or the ear (otorrhea) (Lindsay et al., 2004; Maartens & Lethbridge, 2005). Skull fracture can identify severity of the head injury. Patients with linear skull fracture have higher chance to have intracranial hemorrhage as 400 times in the conscious patient and by 20 times in the comatose patient if compare with patients who have head injury with no skull fracture (ACS, 2004).

Intracranial lesions include focal lesion and diffuse brain injury. Focal lesion is according to the site of epidural hematoma as 0.5% of head injury (ACS, 2004) that is from tear of middle meninglea artery and skull fracture. Bleeding from superior sagittal sinus and diploic veins is possibly occurred that causes hematoma in dura and skull. The bleeding which is large in volume, fast and severe in limited area generates rapid worsen symptom that would require immediate detection and management. Most of treatment outcome is good because brain tissues are not damaged by hematoma. However, the cause of classic lucid interval (talk and die) is as 20% that is the head injured patient had verbal GCS >3 and then GCS was worse to GCS <8 within 48 hours after head injured (McQuillan & Mitchell, 2002). Injured site is mostly found at temporal bone which is delicate that caused tear of artery and vein in middle meninglea (Howard, 2003; Hickey, 2003). Subdural hematoma is found as 30% of sever head injured patients (ACS, 2004) that are caused by the rupture of bridging vein (Howard, 2003) and sometimes from tearing of small surface vessels of the cerebral cortex. Huge hematoma is usually coated on cerebral surface under cranial dura matter with characteristic of cresecent shape (Maartens & Lethbridge, 2005). Furthermore, the brain damage underlying an acute subdural hematoma is usually much more severe than for epidural hematoma. The brain contusion, it is mostly found with intracerebral hematoma if there is huge bleeding at frontal and temporal lobes, are cause from acceleration or deceleration forces of brain that causes severe attack of brain tissue and skull. In addition, lesions can be found at cerebellum and brain stem (ACS, 2004).

Diffuse brain injury this is usually the result from acceleration - decerelation (Dawson & Sander, 2005; Maartens & Lethbridge, 2005) that generates 3 types of centrifugal force according to severity for instance, mild concussion, classic

concussion and diffuse axonal injury (Hickey, 2003). Mild concussion is defined as temporally neurological dysfunction without loss of consciousness, may be neglected as of slight focal neurological deficit. The patients with mild contusion may have amnesia but full recovery is possible (Hickey, 2003). Classic concussion is a result of severe injury from acceleration-deceleration. The patient usually has temporary loss of consciousness and mostly has post traumatic amnesia. Duration of post traumatic amnesia is an indication of head injured severity. The patient should return to be conscious within 6 hours and most likely has no complication but, may have retrograde and/or antegrade amnesia, dizziness, nausea, and depression may be found that can be called as post-concussion syndrome (Hickey, 2003; Roth & Farls, 2000). Diffuse axonal injury (DAI) is from nerve, white and gray matter damages (Dawson & Sander, 2005; Maartens & Lenthbridge, 2005). Degree of severity can be separated by lesion into 3 degrees such as mild DAI, moderate DAI and severe DAI. Mild DAI refers to the patient be in coma after 6-24 hours of head injury with neurological changes. Moderate DAI is that the patient will be in coma after 24 hours of head injury. Those will be excluded if there is brain stem injury. The patients with DAI as 45% will not have full recovery. Severe DAI is found as 36%. The patients usually have lesion at brain stem that can cause permanent disability and/or death (Hickey, 2003; Roth & Farls, 2000).

In conclusion, mechanism and characteristics of head injury in head injured patients who are treated at emergency room include scalp injury, skull fracture and intracranial lesions. As of contact phenomena injury and inertia mechanism injury, intracranial lesions are in focal lesions with diffuse brain injury. This severe pathology is from acceleration-deceleration mechanism.

1.2 Severity of Head Injury

Severity of head injury is significant to predict on the prognosis of head injured patients at emergency room (Iankova, 2006; Stiell et al., 2001). Scoring which is used to determine head injured patients is glasgow coma scale score, a model that is acceptable on accuracy and rapidity. It is an index to measure on severity of head injury, and the prediction of the outcome or prognosis after head injury (Iankova, 2006). Glasgow coma scale can be used to scale severity of head injury in head injured patients who are alcohol drinkers in all cases. Due to the reliable outcome of

glasgow coma scale score, the patients should be presumed that they have head injury, neurological monitoring and recording are significantly needed (Stuke et al., 2007; Sperry et al., 2006). The scale is based on three parameters: eye opening, verbal and motor responses. The patient is given a score in each category, and the categories are summed to obtain a total score. The best score that a patient can obtain is 15, and the worst is 3. The following values are assigned to the assessment parameters (Finfer & Cohen, 2001; Iankova, 2006; McQuillan & Mitchell, 2002)

Eye opening

Open spontaneously	4
Open to verbal command	3
Open to painful stimulus	2
No eye opening at all	1

Best verbal response

Oriented	5
Disoriented	4
Inappropriate words	3
Incomprehensible sounds	2
No vocalisation at all	1

Best motor response

Obeys	6
Localizes pain	5
Withdraws; pulls away from painful stimulus but doesn't localizes	4
Flexion; Abnormal (decorticate rigidity)	3
Extension (decerebrate rigidity)	2
No movement elicited at all	1

There are 3 degrees of head injury as follows: (ACS, 2004; Ingebrihtsen et al., 2000)

1. Mild head injury (GCS score 14-15) refers to little head injury. The patients are conscious and oriented. They can open eyes when call and give immediate or slight delayed response with correct answer (Dawson & Sander, 2005). They may be mildly confused or temporary loss of consciousness after head injury (McQuillan & Batchelor, 2002).

2. Moderate head injury (GCS score 9-13) is defined as medium head injury that the patients gain confusion and less consciousness. They mostly sleep at all time. They still have sense of deep pain stimulation and are awake when people woke them up. They are able to follow simple command or answer simple question but they may take time to answer. In some case, they may slightly move away to escape from pain or make some noise with no meaning if their consciousness is worse. They usually have history of loss of consciousness after head injury (ACS, 2004).

3. Severe head injury (GCS score 3-8) refers to worst head injury. The patients are semiconscious or unconscious (Dawson & Sander, 2005). They are disoriented and incomprehensible sounds. They might move all limbs away from pain or in flexion and distension or abnormal postures or no movement of limbs (Iankova, 2006; Finfer & Cohen, 2001).

Neurotraumatology Committee of the World Federation of Neurosurgical Society (NCWFS) separates mild head injury into three groups which are low risk, medium risk and high risk groups (Fabbri et al., 2004a; Fabbri et al., 2004b; Ingebrigtsen et al., 2001). Low risk group refers to head injured patients who have GCS equal to 15 with no clinical finding of neurological deficit, no skull fracture and no risk factor. Medium risk group can be head injured patients with GCS 15 with clinical findings such as skull fracture and risk factors but no neurological deficits found. High-risk group refers to the head injured patients with GCS 14-15 with or without clinical findings but there are neurological deficits, skull fracture and risk factors. The clinical findings include amnesia, diffuse headache, vomiting, and loss of conscious. European Federation of Neurological Societies (EFNS) defines the head injured patients into four categories as follows (Moppett, 2007; Vos et al., 2002):

Category 0 is a group of head injured patients having GCS as 15 with no loss of conscious during or after head injury, no amnesia and no risk factor. Category 1 gains GCS as 15, loss of conscious < 30 minutes, retrograde amnesia over 1 hour and no risk factor. Category 2 has GCS 15 combining with one risk factor. Category 3 earns GCS 13-14, loss of conscious < 30 minutes, amnesia > 1 hour and with or without risk factor.

From the evaluation by NCWFNS in 6,444 mild head injured patients at emergency room, there are 0.06% of low risk head injured patients with undiagnosed

post-traumatic lesions, 2.5% of medium risk group with post-traumatic lesions, 15.6% of high risk group: age > 60 years with a history of alcohol drinker and post-traumatic lesions and 0.6% of high risk group with undiagnosed post-traumatic lesions (Fabbri et al., 2004a). The high-risk patients with GCS 14 and headache are mostly found to have intracranial lesions with the increased degree of head injury (Fabbri et al., 2004b). The patients who have GCS 15 with unconsciousness or alteration of consciousness, vomiting or headache may have intracranial lesions that require monitoring on neurological signs (Ingebrigtsen et al., 2000).

Risk factors in head injured patients at emergency room include unclear or ambiguous accident history, continued post-traumatic amnesia, retrograde amnesia longer than 30 minutes, traumatic above clavicles including clinical signs of skull fracture, skull base or depressed skull fracture, severe headache (Moppett, 2007; Vos et al., 2002; Ingebrigtsen et al., 2000), projective vomiting, focal neurological deficit, sezuire, age < 2 or > 60 years, coagulation disorders, high-energy accident and intoxication with alcohol/drugs (Fabbri et al., 2004a; Fabbri et al., 2004b).

1.3 Pathology of Head Injury

The head injured patients at emergency room may have hypoxemia and hypotension (Critchley, 2004; Manley et al., 2001; Marik et al., 2002) from vascular injury, tissue injury that affect to inflammatory response, stress response and respiratory center disturbance (Hickey, 2003; Marik et al., 2002). Pathologies of head injury are as follows:

1.3.1 Hypoxemia

Hypoxemia refers to the decrease of partial pressure of arterial oxygen (PaO_2) and arterial oxygen saturation value (SpO_2). Its severity can be estimated into 3 degrees as mild, moderate and severe hypoxemia (McGaffigan, 1997). As head injury, and inflammatory response system releases histamine and prostaglandin combining with catecholamine of stress response that make vasodilatation. Slow blood circulation combining with injury of respiratory center will generate cheyne-strokes respiration due to injured lesions at basal ganglion or deep cerebral hemisphere. Central neurogenic hyperventilation is from injured lesions at mid brain and upper Pons. Apneutic respiration is from injured lesion at pons. Ataxic

respiration is from injured lesion at medulla. Cluster respiration is from injured lesion of lower pons or upper medulla (McQuillan & Mitchell, 2002). Additional causes of hypoxemia are the injured organs that affect to respiration such as flail chest, hemopneumothorax, upper respiratory tract injury and cervical spinal injury (Peunphathom, 2000). Those can also cause hyperventilation. In unconscious head injured patients, airway obstruction due to compressed pharyngeal tone is in common (Cranshaw & Nolan, 2006) and also from bleeding and vomiting (Biros & Heegaard, 2001). From the mentioned causes, patients failed to inhale the oxygen into lung that generates the decreased alveolar hypoventilation combining with slow blood circulation from vascular injury that cause shunt effect or V_A/Q mismatch leading to have the declined hypoxemia in head injured patient. The outcomes of hypoxemia are insufficient oxygen supply at brain and hypercapnia lead to vasodilatation and brain damage that increase cerebral blood flow (CBF) and intracranial pressure in the result with the decreased cerebral perfusion pressure (CPP). Brain tissue damage is from insufficient oxygen supply, respiratory acidosis and lactic acid that cause neurological dysfunction and death of the head injured patients (Manley et al., 2001). Thus, it is significant to attention on immediate assessment and appropriate prevention on hypoxemia in the head injured patients at emergency room.

The assessment of hypoxemia should be started with the assessment on early signs and symptoms within 15-20 seconds that may have neurological changes for instance (Greaves et al., 2006), restless, disorientation, hallucination, hypertension (McGaffigan, 1997), respiratory rate > 18/minutes, decreased pulse rate (Greaves et al., 2006). If there is no appropriate management on those symptoms, the evidence of decreased pulse rate, hypotension, slow breathing and peripheral cyanosis will be occurred as the late signs of hypoxemia. Those signs can be confirmed by blood gas analysis that $PaO_2 < 60$ mmHg (McGaffigan, 1997), pulse oximetry (SpO_2) < 95% (Nichell et al., 2006; Palmer et al., 2001; Finfer & Cohen, 2001). Appropriate nursing care includes opening airway and remove foreign bodies such as blood or food residual, providing oxygen mask with reservoir 10-12 liter/minute in case the patients can breathe by themselves (Dow, 2005). For unconscious head injured patients with GCS < 8, nurses have to immediately notify to physician for intubation and manual axial inline traction (Dow, 2005; Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby

& Menon, 2005). Sniff position should be avoided during respiratory rescue. Oxygen saturation by pulse oxemetry should be closely monitoring as ≥ 95% (Palmer et al., 2001; Finfer & Cohen, 2001).

1.3.2 Hypotension

Hypotension is a status of systolic blood pressure < 90 mmHg. Head injury causes severe scalp laceration and tear of cerebrovascular affecting to have hemorrhage (Turnage & Mauli, 200) that decreases circulation blood volume, red blood cells and hemoglobin. Those cause cerebral vasoconstriction from the stimulation of sympathetic nervous system that decrease cerebral blood circulation volume and blood supply to respiratory center. If blood pressure is low over mean arterial blood pressure < 60 mmHg lead to impaired autoregulation (Roth & Farls, 2000) that generate the increased intracranial pressure from mass effect and the decreased cerebral perfusion pressure (CPP) affecting to insufficient oxygenation of brain tissue(Hickey, 2003; McQuillan & Mitchell, 2002).

Assessment of hypotension will be from signs and symptoms for instance, tachycardia, arterial respiratory swing, delay capillary refill, source of bleeding, oliguria, SBP < 90 mmHg (Kirby & Menon, 2005; Guha, 2004; Hutchinson & Kirkpatrick, 2002). Nursing practice includes managing for intravenous fluid with large needle and temperature of fluid as close as 37ºC (Cranshaw & Nolan, 2006; Dow, 2005). Intravenous fluid used should be Ringer's lactate or normal saline, neither 5% dextrose as it will be viscid that affect to decrease CBF from hyperglycemia nor hypotonic fluid as it will cause brain edema from hyponatremia (ACS, 2004). In addition, the control on SBP > 90 mmHg and MAP > 90 mmHg should be done (Guha, 2004; Marik et al., 2002; Vincent & Berre, 2005). To have only single symptom as hypotension in the head injured patients is slightly found. Head injury should have other combined symptoms such as multiple fractures, thoracic or abdominal hemorrhage (Kirby & Menon, 2005). For nursing practice, it is necessary to have immediately investigation on blood loss and control it.

As mentioned, hypoxemia and hypotension in head injured patients at emergency room cause of the brain damage. If there is immediate assessment and appropriate management according to etiology and pathophysiology of head injury, the balance of brain functions can be reserved. Thus to have clinical nursing practice

guideline for nursing management and constant monitoring on neurological signs may reduce the occurrence of brain injured pathology and death of head injured patients.

2 Concept of a clinical nursing practice guideline for nursing management in head injured patients at emergency room

Head injured patients at emergency room have worse neurological changes from progressive head injury that may cause of death in the patients. Systematic clinical nursing practice is able to assess and prevent hypoxemia and hypotension include reducing mortality rate of head injured patient at emergency room as follows:

2.1 Conceptual care for head injured patients at emergency room

Main objective of conceptual care for head injured patients at emergency room is to prevent and have appropriate nursing management on hypoxemia and hypotension. It can be done by airway clearance, respiratory support, neck immobilization, intubated and assisted ventilation in the patients with GCS < 8, blood circulation, correction of hypotension, and neurological evaluation (Neurological Committee of Thailand and Surgical College of Thailand, 1997). In addition, American Association of Neurological Surgeon (AANS) and Congress of Neurological Surgeons developed the treatment protocol for severe head injured patients by the support from Brain trauma foundation and European Brain Injury Consortium (EBIC) as in Table 1 below:

Table 1: Concept of treatment protocol for head injured patients in America and Europe

Issue	European Brain Injury Consortium (EBIC)	Brain Trauma Foundation
Initial resuscitation	- Clear airway and maintain neck in neural position/C-Collar - Endotracheal intubation when GCS < 9	- Clear airway and maintain neck in neural position/C-Collar - Resuscitation as the ATLS® principle
Oxygenation & Ventilation	- Maintain oxygenate saturation > 95%, PaO_2> 75 mmHg, $PaCO_2$ = 30-35 mmHg	- Maintain PaO_2 > 60 mmHg, $PaCO_2$ ~ 35 mmHg
Blood pressure	- Control SBP > 120 mmHg	- Control MAP ≥ 90
Brain specific therapy	- Administer Mannitol (1.0 gm/kg) when the patient patient is worse or has the symptom of transtentorial herniation. Ensure normovolumia if manitol used. - Prohibit on prolong hyperventilation (PCO_2 < 25 mmHg)	- Administer Mannitol (1.0 gm/kg) when the patient patient is worse or has the symptom of transtentorial herniation. Ensure normovolumia if manitol used. - Prohibit on hyperventilation ($PaCO_2$ < 35 mmHg) within the first 24 hours after accident - CT scan and imaging study of chest, C-spine within 30 minutes

Note: from "Severe traumatic brain injury" by Finfer & cohen, 2001; "The impact on outcomes in a community hospital setting of using the AANS Traumatic brain injury Guidelines" by Palmer et al., 2001

From the Table that compares on the nursing care for head injured patients, initial resuscitation is necessary by assessing and managing airway and maintaining neck in neural position/C-collar including keeping sufficient oxygenation and normal blood circulation. As the comparison on the outcomes of pre and post utilization of AANS TBI guidelines in head injured patients, the finding showed that glasgow outcome scale after using AANS TBI guidelines was higher in the meantime medical expenses for a group using AANS TBI guidelines was higher in each patient (Palmer et al., 2001).

2.2 Nursing management for head injured patients at emergency room

Nursing management for head injured patients at emergency room aims to promote adequate oxygenation and blood circulation including prevent hypoxemia and hypotension (Howard, 2003). In the present, standard nursing care of head injured patients at emergency room is according to the principle of Advanced Trauma Life Support (ATLS®) that include of the 4 following phases (ACS, 2004):

1) **Primary survey and resuscitation** refers to an assessment and immediate resuscitation by assessing and rescuing life with the following sequences (Critchley, 2004; Guha, 2004; Hutchinson & Kirkpatrick, 2002 ; Kirby & Menon, 2005):

Airway & C-collar include appropriate and proper assessment and management on airway and breathing including maintaining neck in neural position/C-collar (Biros & Heegaard, 2001; Cranshaw & Nolan, 2006; Finfer & Cohen, 2001; Guha, 2004; Kirby & Menon, 2005; Marik et al, 2002).

Airway assessment is to evaluate and clear airway by eliminating obstructive objects such as blood, food residual from vomiting, tooth, denture, airway edema and relax pharyngeal tone, especially in unconscious head injured patients (Cranshaw & Nolan, 2006; Finfer & Cohen, 2001).

Airway management: in case the patient has upper airway obstruction, clearing up airway can be done by chin lift and jaw thrust. We should use both hands hold bilateral lower jaw and push outward to lift up mandible. For the patient with suspicious of neck injury, head tilt is seriously prohibited (Cranshaw & Nolan, 2006; Sangchot, 2004). If airway obstruction is from blood or vomiting, the suction should be done to clear airway (Guha, 2004; Kirby & Menon, 2005). For unconscious head injured patients with the suspected basal skull fracture, oropharyngeal airway should

be inserted. For conscious head injured patients, nasopharyngeal airway should be inserted. Oropharyngeal airway will cause vomiting or aspiration (Kirby & Menon, 2005; Sangchot, 2004).

Breathing: Breathing assessment includes capability to breath or the need of breathing assistance (Cranshaw & Nolan, 2006) that involves with breathing pattern, respiratory rate, chest movement, abnomral breathing sound and oxygen saturation measured by pulse oximetry (normal $SpO_2 \geq 95\%$) (Marik et al., 2002; Palmer et al., 2001; Unhasuta, 2006).

For nursing management point of view, if the patient shows full recovery, oxygen mask with reservoir bag 10-12 liter/minute will be provided (Dow, 2005). If the patient has inadequate oxygenation, ventilation assistance by self-inflating bag with O_2 100% should be given that will help breathing through the mask by sealing the mask with face and pressing the bag to maintain assisting ventilation pressure < 20 cmH_2O and low inspiratory flow rate which is slow pressing bag with inspire time < 1 second. The nurse who assists physician should prepare all necessary equipment for intubation. During intubation, the nurse should keep the patient's head and neck in neural position. In case C-collar is taking off, the nurse should provide manual axial inline traction at all time of intubation and avoid sniff position for suspected C-spine injured patients. Oxygen saturation rate should be monitored and not lower than 95% and ventilate $PaCO_2$ = 35 mmHg (Dow, 2005; Sangchot, 2004).

Circulation: Assessment on blood circulation can be done by evaluating the signs and symptoms of the patients for instance, tachycardia, arterial respiratory swing, delay capillary refill, source of bleeding and systolic blood pressure < 90 mmHg (Kirby & Menon, 2005; Marik et al., 2002). It aims to verify the cause of hypotension because it is rarely only single cause of head injury generating hypotension. Hypotension mostly come from combining injuries such as multiple fracture, thoracic or abdominal hemorrhage (Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2005; Palmer et al., 2001).

Circulation management is to control hemorrhage by applying direct pressure to the site (Cranshaw & Nolan, 2006). To maintain adequate fluid balance, Ringer's lactate or normal saline should the best choice, not 5% dextrose nor hypotonic intravenous fluid because it may cause brain edema (Palmer et al., 2001). To prevent

hypotension, maintaining SBP> 90 mmHg and MAP> 90 mmHg should be done (Marik et al., 2002; Kirby & Menon, 2005; Vincent & Berre, 2005; Guha, 2004, Finfer & Cohen, 2001).

Disability: Immediate assessment of neurological status is necessary to verify present neurological signs. It should be periodically repeated to monitor and immediate detect on neurological signs changed. Neurological assessment should be provided immediately after cardiopulmonary stabilization (Fabbri et al., 2004a; Fabbri et al., 2004b; Palmer et al., 2001). It should cover the following aspects:

1) Assess neurological status by using Glasgow coma scale to evaluate severity of head injury that assist providing appropriate specific management (Critchley, 2004; Iankova, 2006; McQuillan & Mitchell, 2002).

2) Eye and pupil signs should be assessed by evaluating both pupils size by flashlight from end of each eye through pupil (Howard, 2003) that can identify abnormal brain lesions. Sluggish pupils are the evidence of cranial nerve III compression. In early stage of brain herniation, pupil sizes are unequal and large pupil does not react to light that represent brain herniation to compress cranial nerve III. Both pupils are equally enlarged and not react to light that mean mid brain is damaged with hypoxemia. If both pupils are equally contracted with no reaction to light, it refers to pons damaged. Medium dilated pupils with no reaction to light refer to midbrain damage (McQuillan & Mitchell, 2002; Myburgh, 2003). Brain herniation can be detected by the signs of severe brain damage such as unequal pupils or dilated pupils, no reaction to light and no physical reaction to deep pain that sign of brain herniaion, and nurse who care must immediately notify to physician (Palmer et al., 2001).

3) Motor function: Neurological assessment focuses on motor function, especially extremities by evaluating muscular function according to the command and comparing mobilization and power of both extremities (Howard, 2003). In unconscious patients, assessment by deep pain at Achilles, sternum, upper orbit and nail (McQuillan & Mitchell, 2002; Myburgh, 2003).

2) Secondary survey and diagnosis evaluation

Overall physical examination aims to detect on the injured sites and gather information that will assist providing appropriate nursing management for head injured patients.

2.1 Gathering history by using AMPLE for instance (Hassan & Tesfayohannes, 2006; ACS, 2004).

- A: Allergies
- M: Medication currently used
- P: Past illness
- L: Last meal (this data is for operation)
- E: Events/environment related to the injury that will assist determining on injured organs and its severity

2.2 History about risk factors related to brain lesion for instance, causes and mechanisms of injury, unconsciousness, memory loss, headache, vomiting, dizziness, convulsion, alcohol drinking, sedative and anticoagulant used (Fabbri et al., 2004a; Fabbri et al., 2004b; Moppett, 2007).

2.3 Physical examination has to be provided from head to toe because head injured patients usually have combined injuries (Moppett, 2007). Clinical findings include sign of basal skull fracture. If head injured patients have GCS 15 with severe headache and vomiting, they will need to monitoring because those symptoms may represent brain lesion (Batchelor & McGuiness, 2002).

2.4 Diagnostic procedure: CT scan of brain should be done immediately in the patients with severe and moderate head injury (ACS, 2004). Risk factors include (Critchley, 2004; Neurosurgical Association of Thailand and Medical College of Thailand, 1997): 1) open or depressed skull fracture, sign of basal skull fracture: hematympanum, raccoon eyes, CSF otorrhea/rhinorrhea, battle's sign (Stiell et al., 2004), 2) convulsion after head injury, 3) focal neurological deficits (Fabbri et al., 2004a), 4) memory loss > 30 minutes, 5) constant vomiting, 6) history of anticoagulant used and severe injury and 7) penetrating cranial injury by monitoring C-spine film in unconscious head injured patients. The patients with mild head injury with risk factors as mentioned should also have CT scan of brain.

3) Re-evaluation and monitoring

Neurological assessment and vital function should be repeated and it should be done every 15 minutes with documentary, which include vital signs, blood pressure, respiratory rate, pulse oximetry, ECG, urine output, arterial blood gas (for intubated patients) (Hassan & Tesfayohannes, 2006; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2006). Evaluating neurological signs will include GCS, pupil size and reaction to light, and weakness at any limbs that need to be recorded with details. Those abnormal signs and symptoms should immediately notify to Neurosurgeon (Biros & Heegaard, 2001; Marik et al., 2002; Vincent & Berre, 2005).

4) Definite care

After underwent the management above, the head injured patients have to be reassessed from attending physician for further management such as the necessity of the surgery from Neurosurgeon or the referral to other high-potential healthcare institute (Hassan & Tesfayohannes, 2006) or close monitoring in ICU and ward according to the pathology of head injury. For referring the head injured patients to other healthcare institute, referral details include previous treatment should be provided. Medical escort with necessary medical equipment should be required during transfer (ACS, 2004; Critchley, 2004; Kirby & Menon, 2005).

Nursing management of head injured patients at emergency room should comprise initial assessment and resuscitation, repeated assessment, clinical review and definite care (ACS, 2004) as in Figure 1.

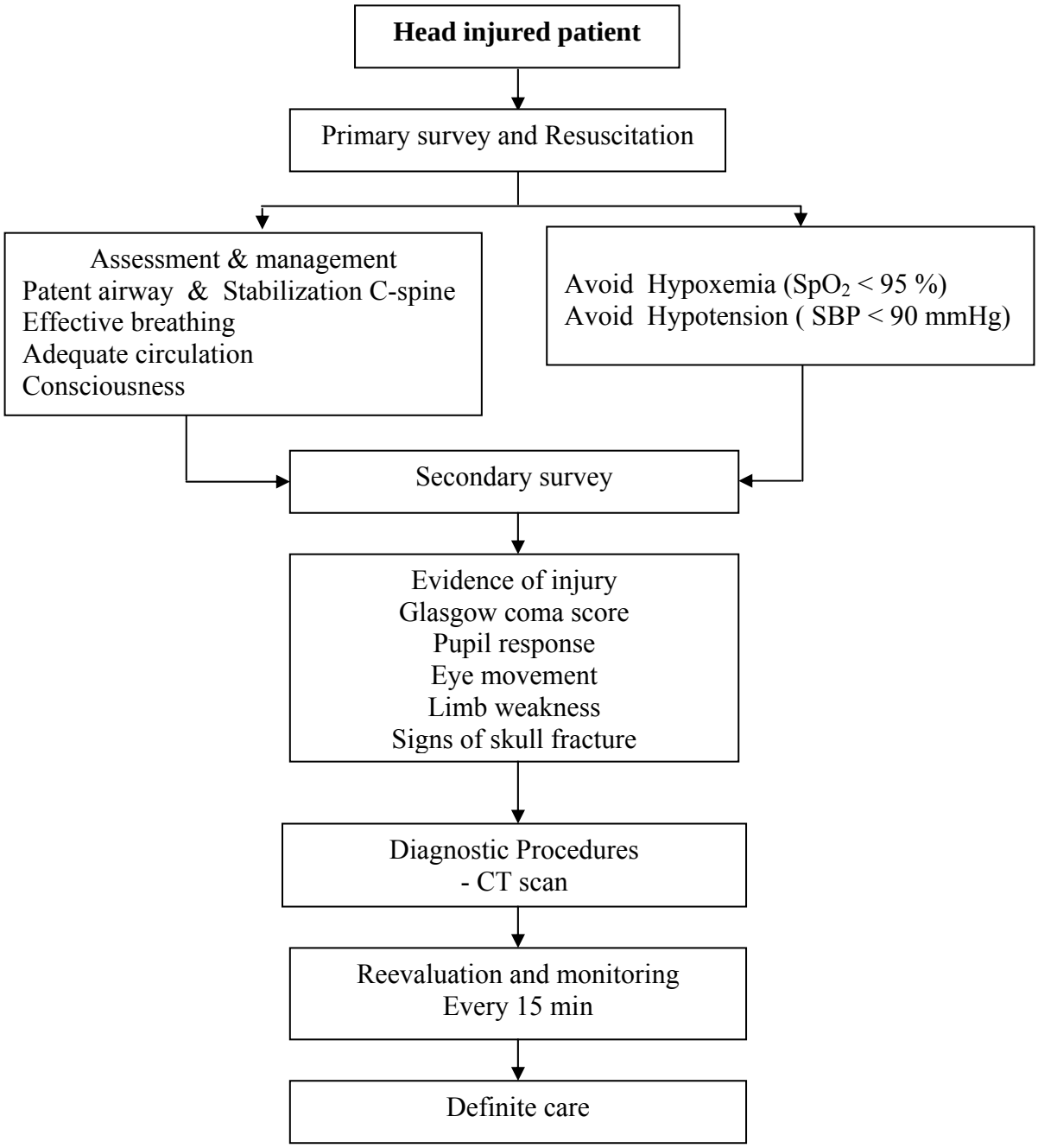

Figure1: Flow chart for the acute management of head injury in emergency room (Adapt from "Acute head injury for the neurologist" by Hutchinson & Kirkpatrick, 2002)

3. Development of a clinical nursing practice guideline

Current development of a clinical nursing practice guideline is developed from literature review, assessment and modification on several empirical evidence-based that aims to assist healthcare providers on appropriate care for the patients with definite clinical deficits (Tilokskulchai, 2006) who require different models of development of a clinical nursing practice guideline.

3.1 Model of development of a clinical nursing practice guideline

In the present, there are several models on the development of a clinical nursing practice guideline such as IOWA Model of Evidence-Based Practice to Promote Quality Care (Titler et al., 2001). Development of a clinical nursing practice guideline is started from improving the practice in terms of clinical or organizational problems with the support data on risk management and total quality assurance such as QA, TQM, CQI, financial data and arousal of innovation from the researches or standard operation in the unit and project implementation according to researches or empirical evidence-based practice (Tiloksakulchai, 2006). Model of The Stetler Model of Research Utilization is a model which is promote and support analytical thinking about the implementation of research outcomes to the operation. It is an individual development. Organization may or may not involve with the development of clinical nursing practice guideline by clinical providers (Stetler, 2001). Evidence-based practice model involves with problem analysis, systematic evidence synthesis, and research utilization to establish the clinical practice guideline with obvious phases and ease of use (Soukup, 2000), that will be modified to develop the conceptual framework in this matter.

3.2 Development of Empirical Evidence-based Practice Guideline

Evidence-based practice model (Soukup, 2000) carries 4 phases as follows:

Phase 1: Evidence-triggered phase is a phase of survey and problem identification by gathering extrinsic data that involve with clinical problems within the interest of correction. Problem identification is from 2 stimuli as practice triggers and knowledge triggers.

Practice triggers: are the triggers from collecting clinical practice information and data

Knowledge triggers: are the triggers from the knowledge from clinical practice development, technological advancement, and nursing practice program improvement

Phase 2: Evidence-supported phase is a phase to utilize the reliable data to support, which is the empirical evidence-based that related to the problem such as literature review on relevant researches and analysis-synthesis of empirical evidence-based. It aims to sort the best supported evidence to develop the innovated effective practice. The emphasized point includes searching on relevant data, evaluating each data, and integrating all to conclude as a body of knowledge. There is the established questions that lead to the best evidence based data. The principles that are useful to establish the questions to sort the best evidence based data are the principles on population setting, obvious interventions or treatment, comparison, evaluation by PICO framework (Menlnyk & Fineout-Overholt, 2005). Patient population or problem is a step to identify population or interested problems. Intervention or area of interest has to be definite. Comparison intervention (if available) and identification will assist limiting on the investigation framework. The outcome has to be definite and measurable. Analysis and synthesis evidence should have clinical relevance, sciencetific merits and implementation potential (Polit & Beck, 2004). Those data should be synthesized and developed to be a clinical practice guideline.

Phase 3: Evidence-observed phase is a phase to present the implementation with appropriate methods and measurable outcomes. A clinical nursing practice guideline (CNPG), which is presented, may be a pilot study, clinical studies or evaluation on practice by consequential studies, feasibility study with the concept of implementation potential (Polit & Beck, 2004). The detail of the concept is as follows.

1) Transferability of finding : The main issue with regard to transferability is whether it makes good sense to implement an innovation in the new practice setting. The transferability questions that, will the CNPG “fit” in the proposed setting? How similar are the target population in the research and that in the new setting? Is there a sufficiently large number of patients in the practice setting who could benefit from the CNPG? Will the CNPG take too long to implement and evaluate?

2) Feasibility : The feasibility issue are concerns about the availability of staff and resources, the organizational climate, the need for and availability of

external assistance, and the potential for clinical evaluation. The feasibility questions that, will nurse have the freedom to carry out the CNPG? Dose the administration support the CNPG? To what extent will the implementation of the CNPG cause friction within the organization? Dose the organization have the equipment and facilities necessary for the CNPG?

3) Cost-benefit ratio : A critical part of any decision to proceed with project is a careful assessment of the costs and benefits of the CPPG. The question that, what are the risk to which patients would be exposed during the implementation of the CNPG? What are the costs of implementation the CNPG?

Phase 4: Evidence-based phase is a phase to prudentially analyze from the data from the evidence-based phase and the evidence-observed phase that is for having the best practice model to adapt to the actual practice and plan on implementation for the success of modern practice.

The summary of the phases in the development of a clinical nursing practice guideline according to the empirical evidence-based as in Figure 2.

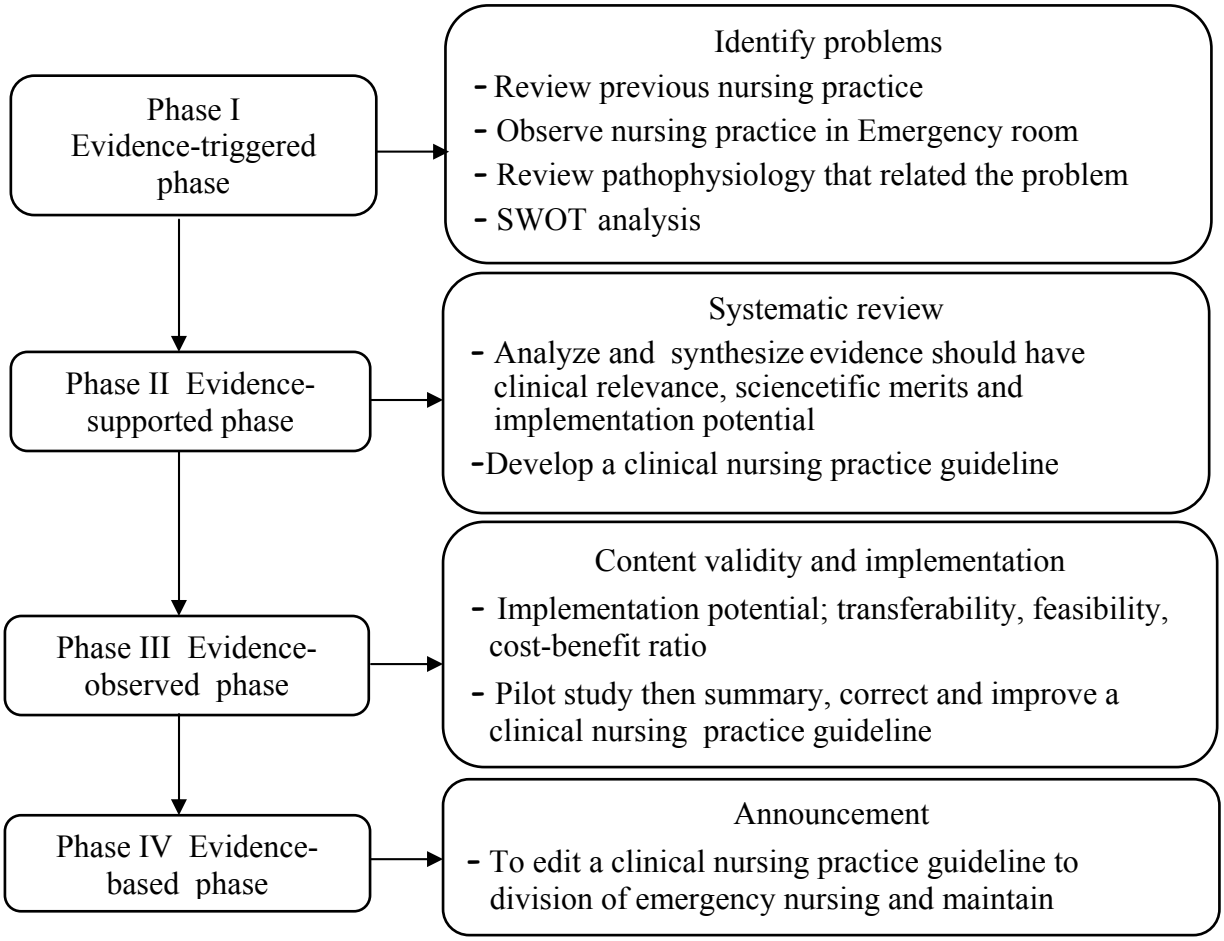

Figure 2 : The empirical evidence based practice

Conceptual Framework of the Study

The conceptual framework of this study includes issues of hypoxemia and hypotension that cause brain dysfunction and severe brain damage from tissue and vascular injury in head injured patients at emergency room. Tissue injury affects to inflammatory response to release histamine and prostaglandin and stimulate catecholamine of stress response in the result of vasodilatation. Slow blood circulation and injury at respiratory center causes abnormal breathing pattern and hyperventilation. The patients cannot inhale oxygen to exchange in lung that makes the decrease of alveolar hypoventilation. In addition, the decrease of blood volume due to vascular injury causes the declined perfusion and V_A/Q mismatch. Thus the head injured patients have hypoxemia. Cerebral hemorrhage from vascular injury affects to have cerebral vasoconstriction. The stimulation of sympathetic nervous system decrease blood to respiratory center and the patient will decrease in conscious affecting to the breathing pattern followed by Hypercapnia and hypoxemia that cause decrease oxygen supply to brain. It combines with hypotension causing the declination of cerebral blood flow. To maintain the mean of arterial blood pressure will keep cerebral autoregulation and normal intracranial pressure including normal oxygen saturation rate. Those will increase cerebral perfusion pressure (CPP) and sufficient oxygen supply so there is no brain tissue hypoxia occurred, as in the Figure 3.

Hence, the development of a clinical nursing practice guideline for nursing management and constant monitoring will assist keeping cerebral hemodynamic or maintain brain function, saving lives of head injured patients at emergency room.

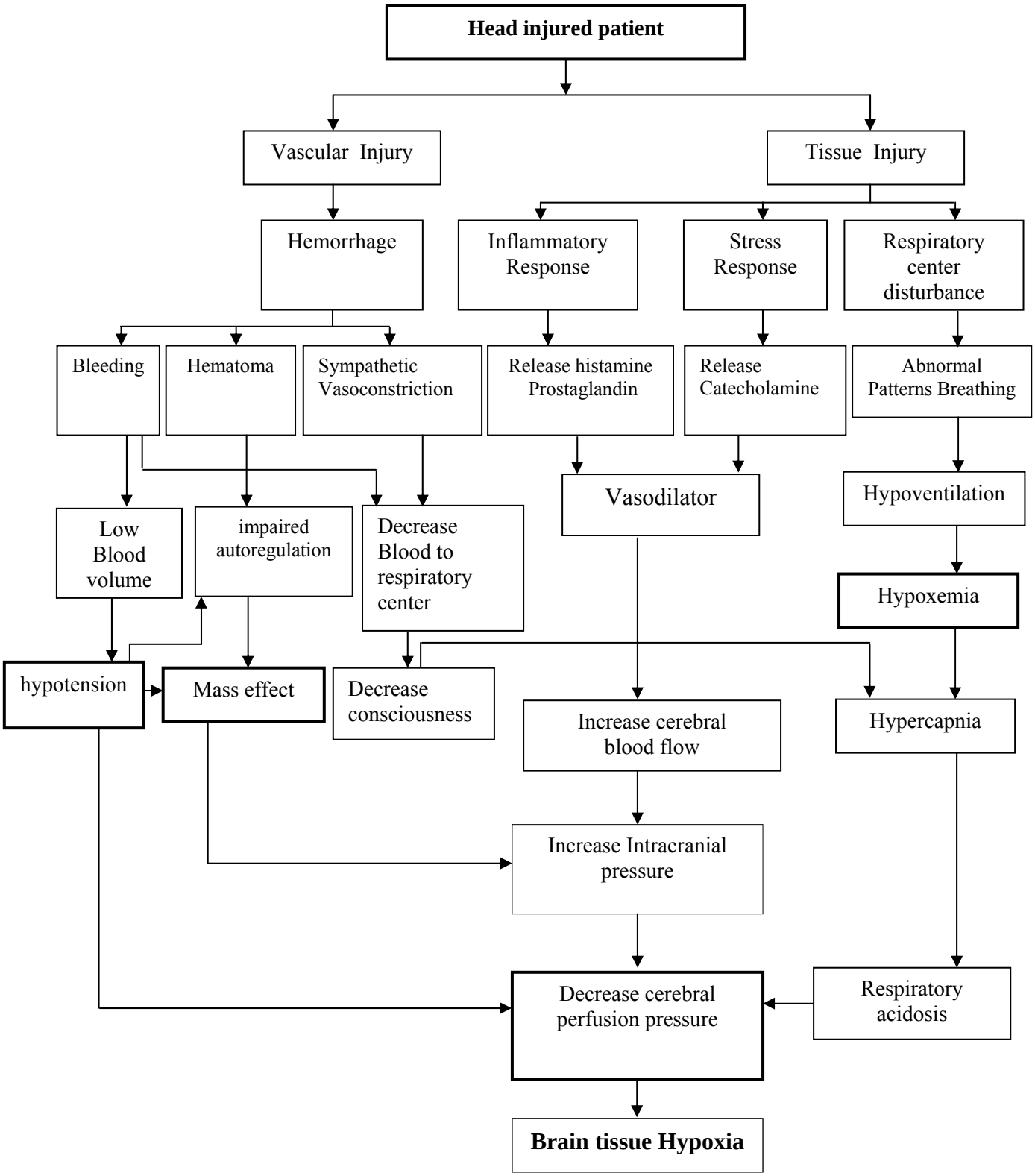

Figure 3 : Conceptual frame work; The pathophysiology of head injured patient (Adapt from Guha 2004; Myburgh, 2003)

CHAPTER III
METHODOLOGY

Select model for implementation

In development of a clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room, the investigator applies the evidence-based practice model (Soukup, 2000) to be a model for implementation. As the reason the model involves with problem analysis, systematic evidence synthesis, and research utilization to establish the clinical practice guideline with reliability that will offer the standard development of a clinical nursing practice guideline with obvious phases and ease of use. The development procedure contains 4 phases as follow;

Phase 1: Evidence-triggered phase: is the phase of practice problem survey and identification. The clinical problems related data in organization are collected and the problems are discovered from the following triggers.

- Practice triggers: are the triggers from collecting clinical practice information and data

- Knowledge triggers: are the triggers from the knowledge from literature review related to clinical practice development, technological advancement, and nursing practice program improvement

Phase 2 Evidence-supported phase: is the phase of obtaining reliable literature or empirical evidence related to identified problem to support a clinical nursing practice guideline development by searching relevant research/empirical evidence, analyze and synthesize the evidences to obtain the best evidence for a clinical nursing practice guideline for nursing standard

Phase 3 Evidence-observed phase: the developed a clinical nursing practice guideline was put into try-out(pilot) implementation.

Phase 4 Evidence-based phase: After studying the evidence observed phase, development and modification of a clinical nursing practice guideline will be implemented for the best practice analyzed and synthesized from evidence based practice of the best practice is used and announced in many settings encountering the same problem.

Process of development the clinical nursing practice guideline

The investigator applies the evidence - based practice model (Soukup, 2000) to study and develop a clinical nursing practice guideline. The detail of the process is as follows:

Phase 1: Evidence-triggered phase is to identify clinical interested problems that need proper solutions. The problems of head injured patients at emergency room are hypoxemia and hypotension.

1.1 Practice triggers

Practice triggers and other relevant data are from actual nursing practice at emergency room of Siriraj Hospital. The investigator conducted the study in 4 head injured patients at emergency room shown in Appendix A. In summary, major problems were hypoxemia and hypotension from airway obstruction and vascular injury. Hypoxemia in head injured patients caused from airway obstruction and bleeding in mouth and nose. The assessment will show the signs and symptoms in table 2, which include tachycardia, SpO2 < 95%. Hypotension is from severe blood loss as severe scalp lacerated. The signs and symptoms of hypotension are tachycardia, arterial respiratory swing, delayed capillary refill, sweating, hypothermia, pale skin, and SBP < 90 mmHg. Severe injury causes cerebrovascular damage leading to have intracerebral hemorrhage and subdural hematoma that stimulate sympathetic nervous system to have vasoconstriction. Due to cerebral hemorrhage and vasoconstriction, inadequate blood circulation to respiratory center is occurred. The following signs and symptoms are alteration of conscious and neurological deficits. Intracerebral hemorrhage may cause hemiplegia.

From the unit analysis by SWOT analysis on nursing care for head injured patients at emergency room at Siriraj Hospital The findings showed both physicians and professional nurses have knowledge and skills to provide care head injured

patients. The unit has clinical practice guideline for head injured patients. Trauma nursing records has to be complete in detail that control quality of care for head injured patients, may be incomplete to record. The nurses in emergency room carry various nursing cares for head injured patients because the unit does not have clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients.

From the working experience at Phrae Hospital, the unit does not have clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room. The incomplete monitoring of signs and symptoms including neurological assessment may be the result of delay treatment; finally the worse condition of the patients may be occurred.

Table 2: Sign and symptom of head injured patients

Sign and symptom		Case 1	Case 2	Case 3	Case 4
SBP		129	146	127	90
Pulse pressure		68	70	75	40
MAP		82.3	99.33	89	93
Respiratory rate		16	20	20	22
Pulse rate		91	106	40	107
O_2Saturation		98	96	95	93
Level of conscious		drowsiness	drowsiness	drowsiness	drowsiness
Glasgow Coma Scale		$E_3V_5M_6$	$E_3V_5M_6$	$E_4V_5M_6$	$E_4V_5M_6$
		14	13	15	15
Capillary Refill		1 sec	1 sec	2 sec	2 sec
Sweating		No	No	No	yes
Skin color		not pale	not pale	not pale	pale
Skin temperature		warm	warm	warm	cool
Pupillary response	Rt	3 RTL	3 RTL	3 RTL	3 RTL
	Lt	3 RTL	3 RTL	3 RTL	3 RTL
Motor Rt/Lt แขน		V/V	V/V	V/V	V/II
Motor Rt/Lt ขา		V/V	V/V	V/V	V/II

1.2 Knowledge triggers

From the literature review related to injury and physical reaction to head injury, head injury can be found with vascular and tissue injuries that affect to inflammatory response, stress response and respiratory center (Hickey, 2003; Marik et al., 2002). The consequences are hypoxemia and hypotension (Critchley, 2004; Manley et al., 2001; Marik et al., 2002) causing inadequate oxygen and blood supply to brain. If there is immediate appropriate assessment and management to solve those problems, physical reaction would be cerebral vasodilatation to compensate blood supply to brain that combines with pathology lesion in brain leading to have the increased intracranial pressure and decreased cerebral perfusion pressure (CPP). Inadequate oxygen to brain causes brain tissue hypoxia and brain cells may get permanent damage without possible recovery (Vincent & Berre, 2005). For head injured patients at emergency room, initial assessment, nursing management and constant monitoring will help preventing hypoxemia and hypotension including worsen head injury, cerebral haemodynamics, and saving the patient's life. As the reasons as mentioned, the investigator develops a clinical nursing practice guideline for nursing management for prevention of hypoxemia and hypotension for head injured patients at emergency room using the Advanced Trauma Life Support (ATLS®), which is the systematic nursing management guideline (Biros & Heegaard, 2001; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2006; Price et al., 2003) according to the steps of primary survey assessment and resuscitation, secondary survey and diagnostic evaluation, re-evaluation and monitoring, definitive care (ACS, 2004). The investigator concludes the pathophysiology of hypoxemia and hypotension see in Figure 4.

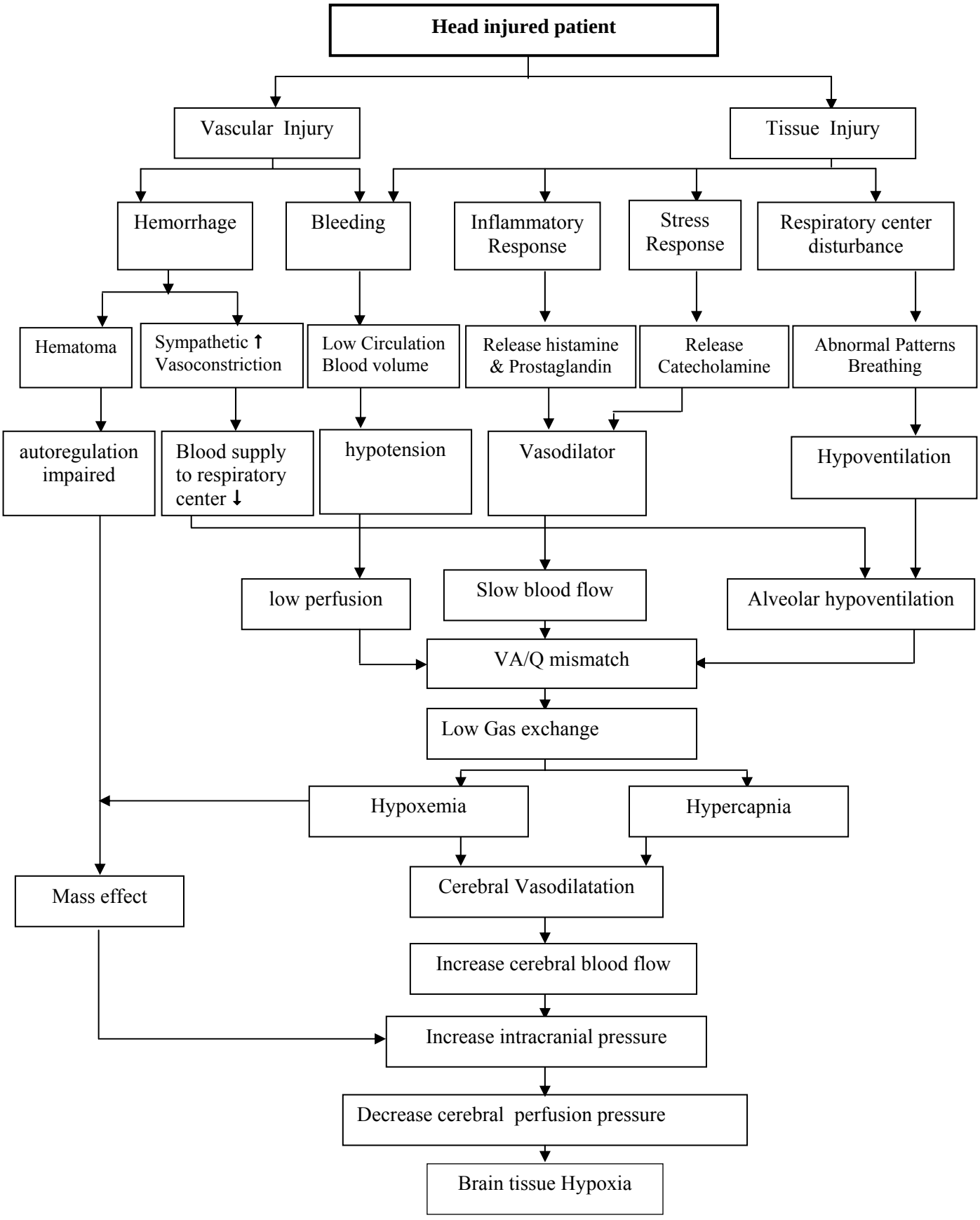

Figure 4 : Pathophysiologic of hypoxemia and hypotension in head injured patient

Phase 2: Evidence-supported phase

This phase selected evidence from many sources, such as research project, expert opinions etc. the evidence is analyzed and synthesized to create a clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room. The step was as follows:

1. Selection criteria

The criteria is to select the evidence from PICO framework (Melnyk & Fineout-Overholt, 2005), relating to the topic of this study using identified population, method, and outcome evaluation. The detail can be explained as follows:

P (Population) : refers to head injured patients at emergency room.

I (Intervention) : refer to a model of the assessment, nursing management and monitoring for head injured patients.

C (Comparison/Intervention) : -

O (Outcome) : refer to head injured patients at emergency room who receive assessment, management and monitoring for prevention of hypoxemia and hypotension.

Inclusion criteria

The investigator specified the criteria for selection and inclusion of research evidences as follow:

1) The research carried out in patient assessment, nursing management and monitoring for head injured patients aged 15 years old and older.

2) All relevant researches were level I-VII according to the classified of Melnyk & Fineout-Overholt. (2005)

3) The research evidences published during 2000-2007 both in Thai and English.

2. Key word for searching

- Head injury and assessment
- Head injury and management
- Head injury and nursing management
- Head injury and monitoring
- Head injury and resuscitation

- Head injury and emergency department
- Head injury and hypoxemia
- Head injury and hypotension

3. Source of evidence search

- Search for standard practice guidelines from www.guidelines.gov
- Search for the systematic review of research from database of www.joannabriggs.edu.au and www.Cocharane.org
- Search for single published and unpublished works from various databases comprising OVID, MEDLINE, CINAHL, ScienceDirect, Blackwell, MDConsult, PUBMED and Highwire press
- Searching from reference list and hand searching

4. Searching result

The investigator searched numerous evidences from many resources and use population, intervention, outcome framework to select the evidence to study. There were twenty studies, 7 researches, 4 articles, and 9 expert opinions. The process of searching evidence, which express numbers of investigated data sources, key words and numbers of researches are shown in figure 5.

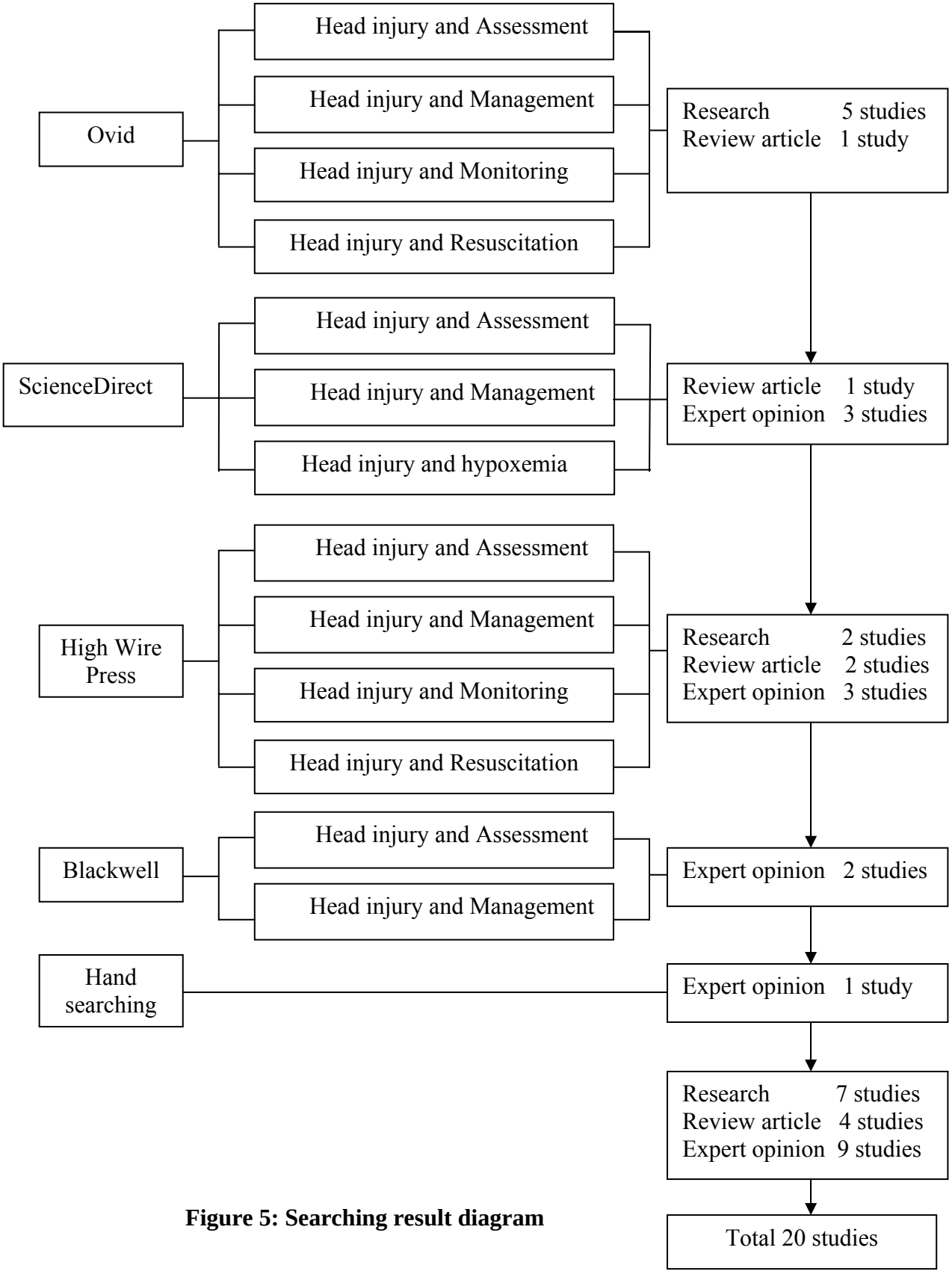

Figure 5: Searching result diagram

The level of evidences is very important to create a clinical nursing practice guideline, it's refer to scincetific merits. In this study, the criteria of Melnyk & Fineout-Overhort. (2005) was used to decide the importance of evidence. All of the levels are shown in table 3.

Table 3: Levels of research evidences

Level and Quality of Evidence	Source of Evidence
Level I	Evidence from a systematic review or meta-analysis of all relevant randomized controlled trials (RCTs), or evidence-based clinical practice guidelines based on systematic review of RCTs
Level II	Evidence obtained from at least one well-designed RCT
Level III	Evidence obtained from well-designed controlled trials without randomization
Level IV	Evidence from well-designed case-control and cohort study
Level V	Evidence from systematic review of descriptive and qualitative studies
Level VI	Evidence from single descriptive or qualitative studies
Level VII	Evidence from the opinion of authorities and/ or reports of expert committees)

The twenty studies were summarized and classified into different levels in level I – level 7 such as one study is in level I, six studies are in level IV, four studies are in level V and nine studies are in level VII. All evidence were classified level of findings and sources of evidence search as show in table 4.

Table 4: Summary and classification of level of the findings

Database	Title	Research design	Level
High wire press	A meta-analysis of GCS 15 head injured patients with loss of consciousness or post-traumatic amnesia	Meta-analysis	1
OVID	The impact on outcomes in a community hospital setting of using the AANS Traumatic Brain Injury Guidelines	retrospectively and prospectively	4
High wire press	Hypotension, hypoxia, and head injury: frequency, duration, and consequences.	Cohort Study	4
OVID	Waiting for the patient to "Sober Up" : effect of alcohol intoxication on Glasgow coma scale score of brain injured patients	Retrospective	4
OVID	Effect of alcohol on Glasgow coma scale in head injured patients	Retrospective	4
OVID	Prospective validation of a proposal for diagnosis and management of patients attending the emergency department for mild head injury	Prospective Cohort Study	4
OVID	Which type of observation for patient with high-risk mild head injury and negative computed tomography	Retrospective	4
High wire press	Management of head trauma	systematic review	5
ScienceDirect	Primer on medical management of severe head injury	systematic review	5
High wire press	Traumatic brain injury: assessment, resuscitation and early management	systematic review	5

Table 4: Summary and classification of level of the findings (continued)

Database	Title	Research design	Level
OVID	Scandinavian Guidelines for initial management of minimal, mild, and moderate head injuries	systematic review	5
Blackwell	Assessment and management of head injury	Expert Opinion	7
High wire press	Prehospital and resuscitative care of the head injured patient	Expert Opinion	7
ScienceDirect	Severe traumatic brain injury	Expert Opinion	7
ScienceDirect	Management of patients with major trauma	Expert Opinion	7
High wire press	Management of traumatic brain injury : some current evidence and application	Expert Opinion	7
Blackwell	Acute head injury for the Neurologist	Expert Opinion	7
ScienceDirect	Acute head injury : initial resuscitation and transfer	Expert Opinion	7
High wire press	Airway management after major trauma	Expert Opinion	7
Hand searching	Airway management of trauma patients (การดูแลทางเดินหายใจในผู้ป่วยอุบัติเหตุ)	Expert Opinion	7

5. Analysis and Synthesis

For this study, analysis and synthesis evidences are performed to develop the clinical nursing practice guideline for head injured patients at emergency room by applied the implementation potential concept (Polit & Beck, 2004). The detail as follow:

Clinical relevance

According to the findings of twenty research studies, all were relevant and can be utilized in; solving for prevention of hypoxemia and hypotension in head injured patients, collecting important data of patients assessment, nursing management and monitoring in head injured patients. Prevention of hypoxemia and hypotension in head injured patients were important nursing roles in multidisciplinary team.

Scientific merits

These finding evidences were reliable since the research carried out the studies base on their experience and expertise as they were physicians and nurses. One study is meta-analysis , six studies are in level IV, four studies are in level V and nine studies are in level VII (Melnyk & Fineout-Overhort, 2005), all of which resulted in reliable research evidence.

Implementation potential

Transferability of the findings was appropriate for emergency unit implementation since the characteristics of trauma unit in the studies and setting were nursing analogous, population in the research also similar. High Feasibility of implementation by nurse in setting. Cost-benefit ratio offers more benefits and enhance neurological outcome, patient and caretaker' s satisfaction.

After used implementation potential in all evidences, the investigator used them to develop a clinical nursing practice guideline for prevention of hypoxemia and hypotension head injured patients for numerous reason. Main issue from analyzed and synthesized in the following:

5.1 Assessment on head injured patients at emergency room consists of respiratory assessment and protection of cervical spine by C-collar, breathing, blood circulation, and neurological system according to ATLS® principles (Cranshaw & Nolan, 2006; Critchley, 2004; Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2005; Moppett, 2007). Initial assessment will offer immediate proper management that helps having adequate oxygen supply and blood circulation to brain tissue including control cerebral haemodynamics.

5.2 Nursing management for head injured patients comprise the management on airway and breathing to prevent hypoxemia, and blood circulation to control blood loss and adequate intravenous fluid to prevent hypotension (Critchley,

2004; Guha, 2004; Hutchinson & Kirkpatrick, 2002; Marik et al., 2002; Vincent & Berre, 2005).

5.3 Nursing management for head injured patients at emergency room with GCS 3-8 are maintain oxygenate $SpO_2 > 95\%$, ventilate $PaCO_2 = 35$ mmHg by intubated and maintain neck in neural position/ C –collar, fluid resuscitate goal MAP $\geq$ 90 mmHg, CT scan, administer manitol 0.25 – 1.0 gm/kg for IC shift/Hemorrhage (Palmer et al., 2001) nurse should provide manual axial inline traction at all time of intubation (Cranshaw & Nolan, 2006; Dow, 2005; Sangchot, 2004).

5.4 The establishment of the development of a clinical practice guideline for head injured patients according to the concept of ATLS® that will improve efficiency of nursing care for those patients (Biros & Heegaard, 2001; Cranshaw & Nolan, 2006; Guha, 2004; Finfer & Cohen, 2001; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2006).

5.5 Assessment and nursing care for mild head injured patients (GCS = 14-15) there are three group of patients: low-risk group, medium-risk group and high-risk group that earns validity on the classification of severity and other risk factors (Critchley, 2004; Fabbri et al., 2004a; Fabbri et al., 2004b; Ingebrigtsen et al., 2004; Moppett, 2007).

5.6 Monitoring on signs and symptoms: the constant monitoring should be repeated every 15 minutes with the complete record in details. It includes vital signs pulse rate, respiratory rate, blood pressure, pulse oximetry, ECG, urine output, and arterial blood gas (Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2006). For unconscious patients, GCS, pupils, and weakness of all limbs should be monitored and recorded. If there is some abnormal neurological signs, immediate reporting to neurosurgeon is the must (Biros & Heegaard, 2001; Marik et al., 2002; Stuke et al., 2007; Sperry et al., 2006; Vincent & Berre, 2005). The monitoring promotes immediate management as needed for the patients.

5.7 Transfer includes escort, timing, monitoring, other equipment and drug, ambulance and trolley, and handover (Kirby & Menon, 2006) that will assist preventing hypoxemia during the transfer for further management such as brain operation.

The description of analyzed and synthesized data is shown in Appendix B. All of evidences synthesized to develop a clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room. This aim is the best practice for head injured patients.

6. Summary of Relevant Concepts

The relevant issues from the review of empirical evidences can be categorized into 3 groups cover patient assessment, nursing management and continuous monitoring as the following summary:

6.1 Patient assessment

1) Initial assessment by ATLS® concept involves with airway management and clearing the cervical spine by C-collar or sandbag to secure cervical spine (Biros & Heegaard, 2001; Cranshaw & Nolan, 2006; Guha, 2004; Finfer & Cohen, 2001; Kirby & Menon, 2005). The risk of associated cervical spine injury about 7-14% in head injured patients (Cranshaw & Nolan, 2006).

2) Assessment and management for prevention of hypoxemia and hypotension by the concept of ABC involve with the evaluation on signs and symptoms, including pulse oximetry. If pulse oximetry is lesser than 95% it means hypoxemia occurred. If SBP is lesser than 90 mmHg, hypotension is existed (Critchley, 2004; Guha, 2004; Hutchinson & Kirkpatrick, 2002, Finfer & Cohen, 2001)

3) Assessment for circulation can be provided by monitoring the signs and symptoms such as tachycardia, arterial respiratory swing, delayed capillary refill, source of bleeding, and oliguria. In addition, the confirmation of hypovolemia is to have CVP done and normal CVP is 8-10 cmH_2O and haematocrit equals to 30%. If hypovolemia is detected in head injured patients, seeking for the etiology is necessary because it is rarely found hypovolemia alone. It is commonly combined with other injuries such as multiple fractures, thoracic or abdominal haemorrhage (Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2005).

4) Neurological assessment can be done by Glasgow Coma Scale, pupil size and light reaction, and weakness of limbs (Critchley, 2004; Hutchinson & Kirkpatrick, 2002).

5) All head injured patients at emergency room who have history of alcohol drinkers should have GCS assessment with measurable reliability. Initial assumption should be the patients had brain injury. Monitoring with detailed record is necessary (Sperry et al., 2006; Stuke et al., 2007).

6) Gathering significant history for instance, age, level of conscious, focal neurological deficit, mechanism of injury, and seizure after accident including history of drug, anticoagulant and alcohol used (Critchley, 2004; Moppett, 2007).

7) Neurological assessment is from physical examination and history gathering after the patient received the primary care (Fabbri et al., 2004a; Fabbri et al., 2004b). The assessment include the following issues:

7.1) Conscious assessment by glasgow coma scale (eye opening, verbal response, motor response).

7.2) Sign of basal skull fracture such as hemotympanum, CSF otorrhea/ rhinorrhea, raccoon eyes, Battle's sign.

7.3) Physical examination to rule out skull compression or skull open fracture.

7.4) Clinical findings such as amnesia, diffuse headache, vomiting, loss of conscious and restless.

7.5) History gathering covering age, causes of injury, characteristic of injury, unconsciousness after accident, amnesia of the accident, headache, dizziness, vomiting, alcohol, drug and anticoagulant used.

6.2 Nursing Management

1) The objective of initial nursing management for traumatic patients is to maintain adequate oxygenation and breathing to prevent organ failure (Cranshaw & Nolan, 2006 Guha, 2004; Hutchinson & Kirkpatrick, 2002; Moppett, 2007) that will promote the effectiveness of multidisciplinary approach (Marik et al., 2002).

2) The nursing management for head injured patients with GCS 3-8 at emergency room by AANS TBI Guidelines is to intubate and maintain SpO2 > 95% and Ventilate $PaCO_2$ = 35 mmHg maintain neck in neural position/C –collar,

fluid resuscitate maintain goal MAP $\geq$ 90 mmHg, CT scan and administer manitol 0.25 – 1.0 gm/kg for IC shift/hemorrhage (Palmer et al., 2001).

3) The application VIP rule in early resuscitation such as Ventilate. Head injured patients suppose to have adequate oxygen by monitoring $SpO_2 \geq 95\%$ and $PaCO_2 = 35$ mmHg. For the patients with severe head injury with GCS $\leq$ 8, intubation is necessary for all. Infusion for resuscitation of head injured patients should be Ringer's lactate or normal saline. Pump to maintain blood pressure should be used to keep SBP > 120 mmHg, MAP >90 mmHg. Other factors include arranging proper position by 30 degree of head lifting to decrease CBF and increase CPP (Guha, 2004; Hutchinson & Kirkpatrick, 2002; Kirby & Menon, 2005; Palmer et al., 2000; Vincent & Berre, 2005).

4) The early management for head injured patients for prevention of hypoxemia involves with maintenance of oxygen and blood pressure in normal limit, no worsen head injury or immediate problem solving. It can be done by the assessment and management which include protect C-spine, adequate airway, ventilation, and circulation (fluid resuscitation), disability (LOC, pupil) (Marik et al., 2002). During resuscitation, SpO_2 should be $\geq 92\%$ (Manley et al., 2001).

5) Airway maneuver is a method to clear airway by arranging head and neck position to prevent or correct the upper airway obstruction. The first method is to do chin-lift by using fingers hold lower mandible and lift chin up and open mouth by a thumb at lower gum. The second method is jaw thrust that can be done by using each hand to hold angle of lower mandible and push out to lift mandible up and forward. Head tilt is prohibited in head injured patients who were suspected to have neck injury (Cranshaw & Nolan, 2006; Dow, 2005; Sangchot, 2004).

6) Airway clearance: There are two kinds of airway. For unconscious patients with suspicious of basal skull fracture, oropharyngeal airway should be inserted. For head injured patients with good conscious, nasopharyngeal airway should be inserted but it will not be good for some cases with the suspicious of basal skull fracture that can be detected by observing the battle's sign, raccoon eyes, otorrhea, rhinorrhea and nasal cavity injury (Cranshaw & Nolan, 2006; Sangchote, 2004). Any foreign bodies have to be eliminated from the airway by suction (Dow, 2005; Guha, 2004).

7) Intubation consists of the following steps (Dow, 2005; Sangchot, 2004):

a) Stabilize neck and head in neutral position and provide manual axial inline traction but be avoid sniff position (Cranshaw & Nolan, 2006)
b) Remove the anterior brace or sand pillow and stabilized sticky tape
c) Give oxygen at least 5 minutes prior to intubation
d) Ask the assistant to compress at cricoid
e) Muscle relaxant is administrated
f) Insert airway and confirm the location of the airway
g) Tight up the airway with sticky tape and use the brace to stabilize cervical spine

8) Fluid resuscitation is achieved initially with the placement of two large bore, peripheral. The assessment of injured lesion must be provided prior to give intravenous fluid. Temperature of intravenous fluid should be nearby 37ºC (Cranshaw & Nolan, 2006; Dow, 2005). Appropriate intravenous fluid is Ringer's lactate or normal saline (not dextrose because it reduces plasma sodium and exacerbates cerebral edema, and causes hyperglycemia which is associated with a worse neurological outcome). Maintenance of blood pressure is necessary with MAP > 90 mmHg (Guha, 2004; Kirby & Menon, 2005; Marik et al., 2002; Vincent & Berre, 2005).

9) Neurological assessment after the patient's condition is stable by using GCS and classification on severity of head injury. Classification of head injury consists of 3 groups, which include severe head injury with GCS $\leq$ 8, medium head injury with GCS 9-13 and mild head injury with GCS 14-15. Nursing management for the patients with mild head injury (GCS 15) is to allow the patient to discharge, it is necessary to have information for patient and caretaker, and instructions. For the head injured patients with GCS 14 with a history of unconscious and amnesia, CT scan of brain should be performed. For the head injured patents with GCS < 13, they should have CT scan of brain done and be hospitalized for further monitoring and treatment (Fabbri et al., 2004a; Moppett, 2007).

10) Classify mild head injured patients into low-risk, medium-risk and high-risk groups and provide appropriate management for each group (Fabbri et al., 2004a; Fabbri et al., 2004b).

6.3 Monitoring

1) Monitoring of signs and symptoms should be started after primary survey but should be done at the time of resuscitation with appropriate equipment (Cranshaw & Nolan, 2006; Dow, 2005)

2) Neurological monitoring by assessing GCS, neurological examination and papillary response. Head-to-toe inspection involves with bruising, lacerated, open fracture, and signs of skull basal fracture. If the patients have those symptoms, neurological condition will rapidly be worse (Hutchinson & Kirkpatrick, 2002).

3) Monitoring signs and symptoms changed every 10-15 minutes by assessing blood pressure, pulse rate and rhythm, pulse oximetry: keep SpO_2 > 95%, MAP 90-100 mmHg, ECG, urine output, end tidal carbon dioxide and arterial blood gas (Kirby & Menon, 2006).

4) For head injured patients with unstable condition, arterial line to monitor circulation and urine catheterization are needed (Cranshaw & Nolan, 2006).

5) Have the record form for continuos care of mild head injured patients at emergency room according to Scandinavian Guidelines, and have instructions for patient and caretaker at discharge (Ingebrigtsen et al., 2004).

6) Referral and transfer service for head injured patients to other healthcare institute that has higher potential. Good communication is the cornerstone of a successful and uneventful transfer, and is important at the time of referral and handover. The assessment and referral care include promptness of ambulance on medication, medical equipment, sufficient oxygen supply for the journey, referral document, actual films, CT scan result and escort. The escort team should have hand-on experience and pass the training about patient care in ambulance that will offer the team to be able to handle properly during transfer. Appropriate medical equipment includes BP monitoring, and ECG monitoring. The head injured

patient has to have stable condition before actual transfer occurred. Close constant monitoring with complete record is required during transfer (Kirby & Menon, 2005).
Potential

7. Pattern of clinical nursing practice guideline

This study creates clinical nursing practice guideline adapted from the pattern of Tiltler (1997, pp115). Is has the detail as shown below and detail of clinical nursing practice guideline as show in Appendix C

7.1 Purpose: A brief statement describes the patient care problem addressed.

7.2 Definition of key term: Operational definition of major terms or concepts in the protocol; it is important that everyone knows the meaning of the concepts.

7.3 Patients at risk: A brief statement or listing of patient populations that is most likely to benefit from protocol; this include a case definition, symtomatology, age or developmental level, and type of disease or condition.

7.4 Assessment: Examples of patient and environment assessments indicate the patients who are likely to benefit from the use of the research based practice.

7.5 Description of the practice: A description or step-by-step guideline on how to carry out the practice indicates what part is research-based by referencing and footnoting the research reports. Algorithms, flowcharts, and tables are useful

7.6 Evaluation: The description of the process and outcome variables is used to evaluate the change in practice. Inclusion of the tools used to measure these variables is favorable. The details shown in Appendix D

- Outcome variable: Through audit of patient records, incidence of problem
- Process variable: Evaluated incidence of problem to implement clinical practice guideline.

7.7 References: Bibliography of research reports use to develop the research-based practice.

Phase 3: Evidence-observed phase

It is a phase to present the implementation with appropriate methods and measurable outcomes. A clinical nursing practice guideline which is presented, may be a pilot study. After developing the clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room based on the twenty studies, the investigator had the content validity to confirm the practical and standardized guideline to use in head injured patients. Expert validation consisted of 7 experts: 4 nurses with emergency specialty, 1 Advance nursing practice in trauma setting, 1 neurosurgeon, and 1 trauma surgeon. The comment from 7 experts is that the established clinical nursing practice guideline has clear context with consistency but it needs to have the details of AMPLE in the secondary survey and adjust the definition of head injured patients who apply the established clinical nursing practice guideline. As the advice from experts, the established clinical nursing practice guideline has to be modified, shown in Appendix C.

Clinical studies or evaluation on practice by consequential studies, feasibility study with the concept of implementation potential (Polit & Beck, 2004) is as follows:

1. Transferability of the findings

An established clinical nursing practice guideline for prevention of hypoxemia and hypotension for head injured patient at emergency room is suitable for the unit that will utilize it. It was developed from the empirical evidences in head injured patient that involves with assessment, nursing management, continuous monitoring, to prevent hypoxemia and hypotension.

2. Feasibility of implementation

The implementation includes assessment, management and continuous monitoring according to a nursing practice guideline for prevention of hypoxemia and hypotension. This is a role of nurse and multidisciplinary approach for patient care. The established nursing practice guideline is simple with no need of special equipment.

3. Cost-benefit ratio

The implementation of the established clinical practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room offers more benefits than previous one. It assists keeping balance of brain function,

prevention of hypoxemia and hypotension, reduce mortality rate, and increase quality of nursing care.

This thematic paper studies had first to third phase but does not bring it to pilot study. However, the investigator plan to pilot study in head injured patients at Emergency unit, Phrae hospital.

Phase 4: Evidence-based phase

It is a phase of prudential analysis based on the data from the Evidence-supported phase and Evidence-observed phase that aims to have the best clinical nursing practice guideline by combining with the actual practice and planning on the actual implementation for new clinical practice model. The investigator plan to implement the established clinical practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room to the investigator's working unit. The details of plan to implementation are as follows:

1. Introduce the established clinical nursing practice guideline for head injured patients at emergency room to the quality control team of the unit for being the standard nursing practice guideline with the continuity of developing plan.

2. Provide the training on the development of nursing care quality for head injured patients to nurses at emergency room. It aims to introduce the established clinical practice guideline for prevention of hypoxemia and hypotension for head injured patients at emergency room and emphasize nurses to know about the significance of implementation of this guideline to improve nursing care quality.

3. Publicize the established clinical practice guideline for prevention of hypoxemia and hypotension for head injured patients at emergency room via nursing journal.

CHAPTER IV
CONLUSION AND RECOMMENDATION

Conclusion

This thematic paper aimed to develop a clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room that can take as well as a standard practice of the unit. It will offer more safety of the head injured patients at emergency room from hypoxemia and hypotension and decrease mortality rate. The investigator used model of the Evidence-based practice model (Soukup, 2000) to develop a clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room. It consists of 4 phases and this study had 3 phases as follow:

Phase 1 is to investigate and identify problems. Hypoxemia and hypotension are major problems of head injured patients at emergency room that can cause the decrease of cerebral perfusion pressure, cerebral hemodynamics, and worse brain injury. The standard protocol, which includes initial assessment, nursing management and continuous monitoring, will assist to prevent hypoxemia and hypotension and save from death of the head injured patients at emergency room.

Phase 2 After the problem analysis, the investigator searched numerous evidences from many resources and use population, intervention, outcome framework to select the evidence to study. There were twenty evidences, all clinical relevant can be utilized in; solving for prevention of hypoxemia and hypotension in head injured patients. The levels of research, the criteria of evaluating the empirical evidences by Melnyk & Fineout-Overhort (2005) were applied. The summary of 20 pieces was used, such as 1 pieces of meta-analysis research (level 1), 6 pieces of retrospectively and prospectively researches (level 4), 4 pieces of evidences from the systematic review of descriptive and quality researches (level 5), 9 pieces of from expert opinion (level 7). The outcomes of synthesis in developing a clinical nursing practice guideline include 3 main issues such as assessment, nursing management and

monitoring to prevent hypoxemia and hypotension in head injured patients at emergency room.

Phase 3 involves with the validation and trial of the established clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room to evaluate the feasibility of its implementation by 7 experts see in Appendix E. The investigator takes the expert's opinion and suggestion to modify appropriate clinical nursing practice guideline as follows:

1. Objectives of a clinical nursing practice guideline for nursing management to prevent hypoxemia and hypotension in head injured patients at emergency room is definitive and consistent with the context of practice guideline without repetition.

2. Definitions of a clinical nursing practice guideline should be definitive and covered the population group, which refers to isolate head injured patients at emergency room.

3. Context of clinical nursing practice is consistent with the research objectives with no redundancy. More details should be added in the secondary survey in the history gathering by AMPLE. Language used should be clear. Key terms should be the same in the whole CNPG without mixed Thai-English words.

4. In the evaluation of CNPG, the question on satisfaction should be the last one.

The clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room is prudentially modified as of the expert's opinion and suggestion see in Appendix C. This studies had the first phase to the phase of developing a clinical nursing practice guideline (Phase III) but do not trial of the established clinical nursing practice guideline in the target group. The investigator plans to pilot study in emergency unit, Phrae hospital.

Phase 4 involves with the prudential analysis to have the best practice model by integrating to actual practice and planning for changing to new model. The investigator plan to implement the established clinical practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room to the investigator's working unit.

Recommendation

The clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room was not implemented in unit, so the investigator could not evaluate on the feasibility of implementation. However, the investigator suggested two separated sections of established clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room as follows:

1. For continuous development of a clinical nursing practice guideline: the nurses who are interested in CNPG need ;

1.1 To pilot study clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room, then evaluate on the implementation potential.

1.2 To analyze the unit and apply clinical nursing practice guideline with previous nursing practice that will lead the change in the unit.

1.3 To evaluation of knowledge and skills on care for head injured patients at emergency room, particularly the nurses have to know ATLS®. Workshop training of a clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room should be provided that assures effective utilization of a nursing practice guideline.

1.4 To promote the realization of the staffs about the significance of the development on nursing quality by using the empirical evidences.

1.5 To present CNPG to public meeting or conference inside and outside hospital; Emergency units of the Ministry of Public Health is suggested.

1.6 To develop and modify a clinical nursing practice guideline every 1-3 years, context of services and new research results.

2. For standard of practice:

The clinical nursing practice guideline for prevention of hypoxemia and hypotension in head injured patients at emergency room should be investigated in the outcome research to test the effectiveness.

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APPENDIX

APPENDIX A
PATIENT' S DATA

Data of studied head injured patient at emergency room of Siriraj Hospital

CASE 1

หญิงไทย อายุ... ปี ญาติให้ประวัติลื่นล้มในห้องน้ำ……..ก่อนมา

V/S แรกรับ BP = 129/61 mmHg, RR= 18 / min, PR = 91 / min, O_2 sat = 98 %

N/S $E_3V_5M_6$ Pupil 3 mmRTLBE , Motor Power Grade V all

Dx. …….

การจัดการและการช่วยเหลือ……..

CASE 2

เพศ……..อายุ……ปี ประวัติ……..

V/S แรกรับ …….

N/S …….

Dx. …….

การจัดการและการช่วยเหลือ……..

CASE 3

เพศ……..อายุ……ปี ประวัติ……..

V/S แรกรับ …….

N/S …….

Dx. …….

การจัดการและการช่วยเหลือ……..

CASE 4

เพศ……..อายุ……ปี ประวัติ……..

V/S แรกรับ …….

N/S …….

Dx. …….

การจัดการและการช่วยเหลือ……..

APPENDIX B

SUMMARY AND ASSESSMENT OF RESEARCH EVIDENCE QUALITY

Researcher name/ Publishing year/ Title	**Summary of Research**	**Analysis of result of research and empirical evidence quality**
……	**Objective:**	**Clinical relevance:**
……	……..	……
……	……..	……
……	**Subjects:**	**Scientific merits:**
……	……..	……
	……..	……
	Results:	**Transferability :**
	……..	……
	……..	……
		Feasibility :
		……
		……
		Cost-benefit ratio:
		……
		……

APPENDIX C
CLINICAL NURSING PRACTICE GUIDELINE

แนวปฏิบัติการพยาบาลเพื่อป้องกันภาวะพร่องออกซิเจนและความดันโลหิตต่ำ ในผู้ป่วยบาดเจ็บที่ศีรษะในห้องอุบัติเหตุฉุกเฉิน

วัตถุประสงค์ (Purpose)

.....

.....

คำจำกัดความ (Definition of key term)

.....

.....

ผู้ป่วยกลุ่มเสี่ยง (Patients at risk)

.....

.....

เกณฑ์การประเมินผู้ป่วย (Assessment)

.....

.....

ข้อตกลงในการใช้แนวปฏิบัติ (Description of practice)

.....

.....

การประเมินผล (Evaluation)

.....

.....

แหล่งอ้างอิงทางบรรณานุกรม (References)

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APPENDIX D

PATIENT'S RECORD

ตอนที่ 1 แบบบันทึกอาการและอาการแสดงของผู้ป่วยบาดเจ็บที่ศีรษะที่เข้ารับการรักษาในห้องอุบัติเหตุฉุกเฉิน

HN……..…….. Date .....Time……..

Sign& symtomp/ Time		…… แรกรับ	……. 15 min	……. 30 min	……. 45 min	…….. 1 hr	…… 1.15 hr	…… 1.30 hr	…….. 1.45 hr	…….. 2 hr
SBP										
PP										
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……		**……**								

Definite care …….. ……

สรุปอาการก่อนจำหน่าย …….. ……

☐ OR ☐ Ward ☐ ICU Trauma ☐ D/C ☐ Refer…..

ตอนที่ 2 แบบประเมินการใช้ แนวปฏิบัติการพยาบาลเพื่อป้องกันภาวะพร่องออกซิเจนและความดันโลหิตต่ำในผู้ป่วยบาดเจ็บที่ศีรษะในห้องอุบัติเหตุฉุกเฉิน

คำชี้แจง ให้ใส่เครื่องหมาย ✓ลงในช่องที่ทีมพยาบาลปฏิบัติตามจริง ตามลำดับข้อดังต่อไปนี้ ในกรณีที่ท่านไม่ได้ปฏิบัติหรือ ปฏิบัติไม่ได้ ขอให้ระบุเหตุผล ลงในช่องเหตุผล

กิจกรรม	**ผลการปฏิบัติ**			
	ปฏิบัติ	**ไม่ได้ปฏิบัติ**	**ปฏิบัติไม่ครบถ้วน**	**เหตุผล**
การประเมินและการจัดการช่วยเหลือขั้นต้น 1. ประเมินทางเดินหายใจและป้องกันกระดูกส่วนคอ เป็นลำดับแรก				
2. จัดการทางเดินหายใจให้โล่งตามขั้นตอนของแนวปฏิบัติ				
3.				
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21.				

ตอนที่ 3 แบบประเมินการใช้ แนวปฏิบัติการพยาบาลเพื่อป้องกันภาวะพร่องออกซิเจนและความดันโลหิตต่ำในผู้ป่วยบาดเจ็บที่ศีรษะในห้องอุบัติเหตุฉุกเฉิน

คำชี้แจง ให้ใส่เครื่องหมาย ✓ ลงในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุด และสามารถแสดงความคิดเห็นเพิ่มเติมในช่องหมายเหตุ

ข้อความ	ความคิดเห็น					หมายเหตุ
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยที่สุด	
1. แนวปฏิบัติมีความง่ายและ ความสะดวกในการนำไปปฏิบัติ						
2. แนวปฏิบัติมีความชัดเจน เข้าใจง่าย						
3. ……						
4. ……						
5. ……						
6. ……						
7. ……						

ข้อเสนอแนะ

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APPENDIX E
LIST OF EXPERT

รายนามผู้เชี่ยวชาญในการตรวจสอบแนวปฏิบัติ

1. รองศาสตราจารย์ นายแพทย์พรพรหม เมืองแมน
   อาจารย์แพทย์คณะแพทย์ศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล
2. นายแพทย์ภานุมาศ ขวัญเรือน
   นายแพทย์ 7 วช ด้านประสาทศัลยศาสตร์ โรงพยาบาลแพร่
3. นางสาวเพ็ญศรี กอบเพชรหยก
   หัวหน้าหน่วยตรวจโรคอุบัติเหตุ งานการพยาบาลผ่าตัด ฝ่ายการพยาบาลโรงพยาบาลศิริราช
4. นางสาวอุไรพร พงศ์พัฒนาวุฒิ พย.ม.
   หัวหน้าหน่วยงานอุบัติเหตุฉุกเฉิน โรงพยาบาลแพร่
5. นางสาวเรวดี ลือพงศ์ลัคณา พย.ม.
   หัวหน้าตึกเวชศาสตร์ฉุกเฉิน วิทยาลัยแพทยศาสตร์กรุงเทพมหานครและวชิรพยาบาล
6. นางสาวปฏิพร บุณยพัฒนกุล พย.ม.
   ผู้ชำนาญทางคลินิกด้านอายุรศาสตร์และศัลยศาสตร์ประจำการตึกเวชศาสตร์ฉุกเฉิน
   วิทยาลัยแพทยศาสตร์กรุงเทพมหานครและวชิรพยาบาล
7. นางสาวกาญจนา เซ็นนันท์ พย.ม.
   พยาบาลประจำการหน่วยตรวจโรคอุบัติเหตุ งานการพยาบาลผ่าตัด ฝ่ายการพยาบาล
   โรงพยาบาลศิริราช

APPENDIX F
EXPERT' S OPINION

แบบให้ข้อคิดเห็นแนวปฏิบัติการพยาบาลสำหรับการจัดการทางการพยาบาลเพื่อป้องกันภาวะพร่องออกซิเจนและความดันโลหิตต่ำในผู้ป่วยบาดเจ็บที่ศีรษะในห้องอุบัติเหตุฉุกเฉิน
โดยผู้ทรงคุณวุฒิ จำนวน 7 ท่าน

รายการ	สอดคล้องกับวัตถุประสงค์ของแนวปฏิบัติ		ความสอดคล้องของเนื้อหาในแนวปฏิบัติ		ความซ้ำซ้อนของเนื้อหาในแนวปฏิบัติ		ความชัดเจนของเนื้อหาในแนวปฏิบัติ	
	สอดคล้อง	ไม่สอดคล้อง	สอดคล้อง	ไม่สอดคล้อง	ซ้ำซ้อน	ไม่ซ้ำซ้อน	ชัดเจน	ไม่ชัดเจน
1. คำจำกัดความ								
2. ผู้ป่วยกลุ่มเสี่ยง								
3. เกณฑ์การประเมินผู้ป่วย								
4. ข้อตกลงในการใช้แนวปฏิบัติ								
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ข้อคิดเห็นเพิ่มเติม.....
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BIOGRAPHY

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