Clinical Case Study: Gunshot Wound

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The purpose of this case study is to display the thoughtful process of planning, implementing and evaluating the holistic care of a patient admitted to an intensive care unit (ICU). The patient to be studied is R. A., a 22-year-old mixed-race male with a self-inflicted gunshot wound to the head. This patient was a military officer, a brother of two sisters, and a son of divorced parents. His family resides in Ohio. Past medical history included depression with previous psychiatric admissions. Reportedly, the young patient was at a public gun range when he was seen falling backward out of the shooting stall unconscious and unresponsive with a gunshot wound to his head. Video recordings do not actually show the patient or another person inflicting the wound, and only depict the patient falling backward after the incident. Other evidence, such as the entry and exit wounds, indicates that the injury was in fact self-inflicted. The patient was rushed to Virginia Beach General Hospital, a level-two trauma center, where he was resuscitated. Shortly after the patient was admitted to the ICU for further evaluation and the family was notified. The patient was still unresponsive to any type of stimulation at that time. This paper will include detail about the outcome, intervention, and evaluation stages of the patient's care related to the medical and nursing diagnoses.

Medical Diagnosis

R. A. was medically diagnosed with a penetrative brain injury related to self-inflicted gunshot wound to the head, as noted from the electronic medical record. With further investigation of this case, the patient more specifically endured a perforating brain injury, as there is an entrance and exit wound. In the case of a penetrative brain injury the bullet would have entered the skull and stayed imbedded in the brain matter. In this case, the bullet traveled straight through the skull and brain before exiting the body altogether, making it more properly

identified as a perforating brain injury (Urden, Stacy & Lough, 2014). This makes a significant difference in the pathophysiology.

Pathophysiology

This patient's perforating brain injury was graded as severe in nature, as the patient's Glasgow Coma Scale (GCS) score was less than eight after resuscitation. The GCS is a way of evaluating neurological status based on eye, verbal and motor responses (Urden, Stacy & Lough, 2014). This patient's GCS score of three, which is the lowest score possible, puts the extent of the injury into perspective. When mechanical forces come into contact with the brain, such as when a bullet penetrates the skull, primary and secondary injuries result.

The primary injury involves the direct damage that the mechanical force causes immediately when coming in contact with the brain (Urden et al., 2014). The primary injuries in this case were the open skull fractures inflicted on entry and exit of the nine millimeter round and the physical tract of brain matter destruction as the bullet passed through the head. The primary injury also involved excessive subarachnoid bleeding. The secondary injury is additional destruction of brain tissue caused by the cellular response to physical and chemical changes that resulted from the primary injury (Urden et al., 2014). A main cause of secondary brain injury in this patient was cerebral edema. Inflammation of the cerebral tissue can be caused by excessive bleeding, the presence of a foreign body inflicting traumatic physical injury and by hypoxia and hypercapnia from decreased or absent respiratory function after the injury (Urden et al., 2014). Hypoxia is the failure to meet the cells' demand for high levels of oxygen during an increase in cellular metabolism that occurs in order to repair the damaged tissue. The lack of oxygen supply then results in ischemia and cell death. Dying cells burst into cellular debri, which then increases inflammation due to an influx of cellular mediators that participate in vasodilation, phagocytosis,

and elimination of dead tissue. Hypercapnia is an excess amount of carbon dioxide, which is also a result of decreased respiratory function over a period of time. Because carbon dioxide is a vasodilator of blood vessels that supply cerebral tissue, hypercapnia also contributes to cerebral edema (Urden et al., 2014).

Cerebral edema resulting from the insults discussed above ultimately causes cerebral blood vessels to be compressed. Cerebral vessel compression causes further impaired perfusion and ischemia to the brain tissue. However, open brain injuries have open wounds that allow cerebral edema and increased intracranial pressure (ICP) to escape. Closed brain injuries are more likely to cause the brain to hemorrhage down through the foramen magnum at the base of the skull with increased ICP, causing death in most cases. In the case of this patient with open head wounds, the expanding intracranial matter was exhibited as copious drainage on the head bandage.

Signs and Symptoms Related to Pathophysiology

Inflammation at the site of injury was evident in the way that the brain tissue was consistently oozing from both wounds. This patient's initial head computerized tomography (CT) scan showed the tract of the bullet as well as subarachnoid bleeding throughout the brain with a hematoma on the left side causing a midline shift of the brain from the left to the right. The midline shift away from the hematoma actually shows that the bleeding is in fact causing cerebral edema and increased ICP. Bone fragments lodged into the brain matter from the entry of the bullet were also shown on the initial head CT. The need for rapid-sequence intubation in the field indicated hypoxia. Long-term hypoxia can also result in multi-organ failure elsewhere, which did not seem evident upon further evaluation of his condition while in the ICU. Initial

arterial blood gasses (ABGs) did show elevated carbon dioxide, which would cause vasodilation and further edema.

One very interesting symptom that developed while the patient was in the ICU was polyuria, in which sometimes the patient would void more than 700 milliliters of urine in one hour. This symptom was explained by the fact that an inadequate amount of antidiuretic hormone (ADH) was being released from his brain as a result of the trauma. ADH is a hormone that tells the body to retain fluids in order to prevent dehydration. So, when there is inadequate ADH, polyuria occurs. Likely, the bullet damaged the hypothalamus in the brain where ADH is produced and/or the pituitary gland where ADH is stored and released. This entire process of a lack of ADH or lack of a response to ADH in the kidneys (which is not the cause in this case) is called Diabetes Insipidus (DI). Besides polyuria, the patient's low urine osmolality and urine specific gravity were possibly indicative of DI in this case, as they demonstrate the extent of urine dilution (Urden et al., 2014).

Nursing Care Plan

Nursing Diagnosis #1: Ineffective Breathing Pattern

The number one priority nursing diagnosis for this patient was ineffective breathing pattern related to neuromuscular impairment. This diagnosis is the priority as no other body system can function without oxygen, making the immediate restoration of the respiratory system crucial to the patient's outcome. This diagnosis is evidenced by the need for immediate intubation in the field by first responders. Also reflecting this diagnosis, ABGs showed elevated carbon dioxide levels in the blood causing respiratory acidosis. Later in the patient's ICU stay, apnea testing was performed. This involves removing the inspiratory support from the ventilator so that the patient's carbon dioxide will rise. This rise in the carbon dioxide level should trigger

the patient's brain to tell the body to breath. Initially, this mechanism was still slightly working and the patient was able to take very few spontaneous breaths without ventilator assistance. After a two to three days, the patient was no longer taking these spontaneous breaths, indicating complete neuromuscular dissociation.

Nursing theory. A nursing theory that is well associated with this patient and especially this nursing diagnosis is Dorothea E. Orem's Theory of Self-Care Deficit. This patient was in need of complete care by the nurses due to his neurological compromise. Dorothea Orem notes that a self-care deficit surfaces when neither the patient nor the family is able to provide necessary life-sustaining care. When this happens, it is the nurse's responsibility to fill the gap (Johnson & Webber, 2010). The ability to breathe is the most basic of all life functions, so a patient who is unable to do so on his or her own has the ultimate self-care deficit. When the patient came to the hospital, the nurses and other providers were able to supply the advanced life support and the resources needed that would otherwise be inaccessible to the patient and family. After initial intervention, continuous respiratory support was sustained. In this, Orem's Self-Care Deficit theory was clearly incorporated into nursing care.

Outcomes. The first outcome identified for this patient was that he would be able to take at least ten spontaneous breaths per minute before the end of the shift that day. Because the patient was taking about three spontaneous breaths the day before, an increase in this effort to a ten would have been a significant neurological and respiratory improvement. In the longer term, it was expected that the patient would be able to be weaned off of the ventilator within one week.

Interventions and critical thinking. The main respiratory intervention applied to this patient was intubation with continuous mechanical ventilation. Due to the patient's inability to take in air using his diaphragm, intercostal muscles, and other accessory muscles the ventilator

has to directly push air into the lungs through an endotracheal (ET) tube. Ventilator settings are important when allowing for adequate gas exchange. In this case, the ventilator was programed to allow a set amount of volume to be pushed into the lungs while the pressure by which the air enters the lungs is variable. Critical thinking explains that, allowing for pressure changes based on the resistance the patient is providing decreases the risk for barotrauma to the lungs. Also, the patient was on positive end-expiratory pressure (PEEP) at five cmH2O. This means that at the end of each exhalation, positive pressure is maintained by the ventilator to keep the patient's alveoli open. By keeping the alveoli open, alveolar collapse is prevented which promotes gas exchange. However, critical thinking about the cardiovascular system explains that the increased end-expiratory pressure in the lungs increases the resistance of blood flow coming from the right ventricle. This can add extra stress to the cardiovascular system. In this case, the benefit of improved gas exchange outweighed the risk of slightly increasing the cardiovascular stress with a relatively low PEEP level (Urden et al., 2014).

One nursing exploratory descriptive research study used interviews to determine how well 58 nursing professionals performed mechanical ventilation care. Multiple areas of ventilation care were evaluated including washing hands before procedures, frequency of suctioning, technique used when suctioning, checking cuff pressure, checking the humidifier, reaction to alarms, and other aspects. The study found that the nursing professionals were most consistent with washing hands before procedures and with suctioning frequently, but were least consistent with checking cuff pressure. This study relates to the patient, as nursing staff can easily overlook many of these factors when taking care of a ventilated patient such as this one. By reviewing the results of this study, it is a reminder that proper management of a ventilated patient involves attention to all aspects of the machine itself (Mesquita et al., 2014)

Mechanical ventilation is collaborative effort, as respiratory therapists handle most of the ventilator settings, and a dependent task, as the nurse is dependent on the doctor to intubate the patient. Another collaborative and dependent intervention was the ABG draws, which require the respiratory therapist's skill and the physicians order. Independent nursing interventions for this neurologically impaired patient included close monitoring of lung sounds, respiratory rate and oxygen saturations as well as raising the head of the bed and suctioning excess respiratory secretions. These interventions prevent aspiration and promote gas exchange.

Intubation is a very invasive procedure in which a foreign object is placed in the sensitive lung environment. For this reason, intubated patients are at a high risk for ventilator-associated pneumonia (VAP). Sentara has developed specific standards of practice to prevent infection. The most applicable clinical pathway for this specific patient and diagnosis is the guideline on ET tubes with continuous aspiration of subglottic secretions (CASS) capabilities. It is defined that patients with these devices should have oral cavity suctioning with the yankaeur tip at least every four hours and the yankaeur tip should be replaced every 24 hours. Oral care kits should also be replaced every 24 hours and oral care should be performed every four hours. Every 12 hours oral care should be performed with chlorhexadine solution and for the remaining hour intervals the regular oral cleanser that comes with the green oral care swabs should be used (Sentara, 2014).

Education. All of the education about the patient's overall condition was provided to the family, as the patient himself was unconscious. The family was educated on the fact that the patient needed to be on the ventilator because his brain was not able to tell him to breath on his own. This was confusing to the family as his heart was beating on its own. However, further education was provided to them that the heart could work independently from the brain through

automaticity. It was difficult for the family members to understand the severity of the patient's condition when it appeared as though the patient was breathing on his own. The family was also briefly taught how the ventilator works to breath for the patient as described above. Furthermore, the family was informed that all organs except for the brain were healthy.

Nursing Diagnosis #2: Risk for Ineffective Tissue Perfusion

This patient was at risk for ineffective tissue perfusion related to trauma to the head with substantial blood loss. Ineffective tissue perfusion eventually causes ischemic damage and death of the body's organ tissues; however, further evaluation showed no evidence of actual multiple organ damage, which is why he was only at risk for inadequate perfusion. On the other hand, there was actual evidence of hemodynamic instability, as the patient was hypotensive and tachycardic. Furthermore, the patient had a low hemoglobin of 9.5 g/dL and low hematocrit of 25.1 g/dL, which compromises tissue perfusion. This diagnosis falls second in priority only to ineffective breathing pattern due to the possibility of very rapid decline in condition.

Nursing theory. The nursing theory congruent with this diagnosis is Sister Callista Roy's Adaptation Model. This theory notes that as an individual goes through illness, he or she must adapt holistically to survive. In this case, the patient physically had to adapt to the substantial blood loss by using the body's compensatory mechanisms such as increasing the heart rate. Also, the family had to adapt their own lives and coping mechanisms after getting news that their loved one endured a possibly fatal injury (Johnson & Webber, 2010).

Outcomes. Because the patient is at risk for ineffective tissue perfusion, the main goal was to prevent further decline of the patient's ability to oxygenate his organ systems. The first outcome was that the patient maintain adequate tissue perfusion throughout hospital stay as evidenced by a blood pressure within 20 mmHg of baseline, a normal sinus rhythm with a rate of

60-100 bpm, urine output of greater than 0.5 mL/kg/hour, strong peripheral pulses, and warm extremities with brisk capillary refill. Due to the risk of blood coagulation with low perfusion states, another outcome for this patient was that he remain free of signs of deep vein thrombosis, pulmonary embolism, disseminated intravascular coagulopathy, myocardial infarction, and other clotting pathologies during his ICU stay.

Interventions and critical thinking. In order to monitor the unstable blood pressure in the most accurate way possible, an arterial line was inserted on arrival of the patient to the unit. Also, a central line was inserted in the emergency department so that a more direct and reliable vascular access was available for the administration of vasopressors, other medications, and fluids. Isotonic fluids were strategically administered first to the patient. Critical thinking explains that isotonic fluids were administered because they stay in the vascular space and improve fluid volume, preload, cardiac output, and overall perfusion. Also, fluids were administered before vasopressors, such as norepinephrine (Levophed) and phenylephrine (Neosynepherine), because if there is no volume in the vascular space, then the vasopressors will have no volume to push back to the central circulation (Urden et al., 2014). Later in the hospital stay, the patient was started on hypotonic D5W solution to help push fluid into the cells and to also prevent further fluid loss caused by DI that he was arbitrarily experiencing. Coagulopathy labs were drawn to determine risk for excessive bleeding or excessive clotting and arterial blood gasses depicted accurate blood oxygenation levels. Arterial line insertion, central line insertion, fluid and medication orders, arterial blood gasses and lab draws were all interventions dependent on a physicians order with some collaborative measures with respiratory therapy as well.

Independent nursing interventions included attentive monitoring of vital signs such as blood pressure, heart rate, and oxygen saturations, followed by the titration of vasopressors

according to the patient's status. Another independent nursing intervention was careful monitoring of fluid intake and output, as adequate urine output directly correlates to adequate perfusion to the kidneys. Additionally, the nursing task of maintaining normothermia of the patient was crucial to decreasing oxygen demand and maintaining perfusion (Urden et al., 2014).

The importance of maintaining normothermia was demonstrated in one nursing research article that discussed the effects of non-infectious hyperthermia on cerebral perfusion pressure, GCS, and ICP. This was a retrospective medical record review of 126 traumatic brain injury patients with a non-infectious fever within the first 72 hours of the incident. The study found that on the second and third day of admission, patients with hyperthermia had significantly higher ICP and significantly lower cerebral perfusion pressure, indicating a poorer outcome. Also, GCS scores were lower in hyperthermic patients during this time frame. Therefore, the study reinforces the importance of maintaining normothermia in patients with traumatic brain injuries (Oh, Jeong, & Seo, 2012).

Patients such as R. A. who are in need of vasopressors to improve overall profusion are required to have a central venous line in which to administer them. With the insertion of central lines, the risk for blood stream infections increases. For this reason, strict protocol has developed for nursing care of these lines. For example, when drawing blood from a central line the port should be cleaned alcohol or alcohol port protectors. Also, sterile protective caps should be applied to the ends of the disconnected tubing while drawing blood to prevent contamination. The opened ends of the tubing should never be looped back around and connected to the piggyback ports, as this can also introduce bacteria. Considering a hypovolemic or anemic patient, it is also important to only take the lowest amount of blood needed from the patient to

prevent hospital-acquired anemia. This patient was hypovolemic at one time and was anemic with low hemoglobin and hematocrit levels (Sentara, 2014).

Education. As stated before, all teaching was provided to the family due to the patient's condition. However, the family was enduring major psychological stress and was not ready to receive detailed teaching about the patient's hemodynamic condition and correlating therapies. Given this, the teaching was focused simply on keeping the family generally informed about what interventions were being done and what the next step was for the patient and family. For example, when the respiratory therapist entered the room to draw arterial blood gasses or when the nurse was drawing labs off of the central line, the nurse would just explain to the family that blood was being taken to determine how the patient's organs were functioning, how well his blood was oxygenated, and to gain a general look at the patient's condition. Although unrelated to tissue profusion, most of the teaching during the entire length of stay focused on determining level of brain functioning and brain death.

Nursing Diagnosis #3: Decreased Intracranial Adaptive Capacity

The third priority nursing diagnosis applicable to this patient was decreased intracranial adaptive capacity related to traumatic brain injury causing profuse bleeding and cerebral edema. As noted in the pathophysiology section, traumatic brain injury causes cerebral edema and bleeding occur at too rapid a rate for the body to compensate. There are three main things in the brain that take up space including brain matter, blood and cerebrospinal fluid. The body compensates for an increase of one substance by decreasing another. With too rapid of an increase of one or more substances, compensatory mechanisms fail causing increased ICP. Evidence that R. A. demonstrated for this process was the constant outflow of brain matter from the head wounds, midline shift on the CT scan, decreased level of consciousness, decreased

GCS, loss of oculocephalic and oculovestibular reflexes and lack of corneal and gag reflexes (Urden et al., 2014).

Nursing theory. Similar to the diagnosis of ineffective tissue perfusion, Sister Callista Roy's Adaptation Model explains the process of decreased intracranial adaptive capacity. The congruency is even in the name. The diagnosis revolves around the idea that without the compensatory ability to decrease the amount of a substance to account for an increase in another substance within the confined skull, increased ICP will result and neurological deficit will occur. Even though the increase ICP could not be numerically calculated in this patient because of the open head wounds, other signs noted above proved that the skull did not have enough room to contain the cerebral edema and hemorrhage. This demonstrates a lack of adaptation.

Nursing Diagnosis #4: Risk for Infection

The fourth nursing diagnosis was risk for infection related to the penetration of a foreign object through the protective barriers of the skin and skull. Furthermore, the entry and exit wounds were left open to allow for cerebral edema, which further exposed the patient to infection. In this patient, an elevated white blood cell count and a climbing temperature evidenced infection. Additionally, the patient was at risk for a secondary infection related to multiple arterial and venous line insertions, intubation, and insertion of a Foley catheter. Infection is also concerning as it takes energy to fight off the pathogen, increasing the metabolic demand.

Nursing theory. This is another nursing diagnosis that relates to Roy's Adaptation Model. In this case, the patient's elevated white blood cell count and elevated temperature were signs that the body was adapting to try fight off the pathogen in order to survive. In order to assist in the patient's adaptation, intravenous antibiotics were administered.

Nursing Diagnosis #5: Grieving

The primary psychosocial nursing diagnosis is grieving of family and friends related to the anticipatory loss (and eventually the actual loss) of a significant other. This was especially prevalent as the patient was very young, and because the mechanism was very brutal and abrupt. Defining characteristics included family members and friends crying in despair. At some times the family partook in the anger stage of grief. The mother was particularly upset by the plethora of tubes, lines and machines attached to the patient. Other people noted how the patient did not even look like himself, symbolizing another defining characteristic of grief called detachment. However, mostly the family members and friends confided in each other during this difficult time.

Nursing theory. Boykin and Schoenhofer's Theory of Nursing as Caring helps to portray the nurses role when it comes to grieving family members and friends. The theory states that caring is the most critical element of nursing and that the relationship between the nurse and each person being cared for is unique. In this, the role of the nurse in this situation is to provide support to the loved ones of the patient in a way that is tailored to the individual's needs. The nurse should also promote healthy support systems that can help to provide that care outside of the hospital.

Cultural Considerations

The most prevalent culture that the patient was a part of was the military culture. During the stay in the hospital, an astounding amount of the patient's military friends were escorted in pairs to the patient's bedside. There was almost a constant influx of military coworkers during the visiting hours. One would think that all of those military friends, coworkers, and authority figures would provide for a very strong support system and would prevent suicidal tendencies.

However, this was not the case. The patient was separated from home and was in a relatively new environment, as he had just recently graduated college and joined the military. Apparently, the patient even expressed his suicidal thoughts to the authority figures where he worked, and the appropriate action was not taken. For these reasons, a nurse should never assume the stability of a support system and should evaluate how the patient identifies with his military culture.

Evaluation

Unfortunately, the patient was declared brain dead a few days after admission to the ICU. In this, all of the above outcomes that marked improvement were unmet. However, an alternative plan was brewing well before the patient was declared dead. The alternative plan of organ donation was presented to the family when their loved one was pronounced brain dead and they agreed to proceed. This decision was left up to the family, because the patient had not signed up for the organ donation list already. The LifeNet staff then took over care of the patient and ordered medications such as levothyroxine and methylprednisolone (Solumedrol) to optimize organ function before the harvest. Many more tests and imaging studies were ordered to rule out diseased organs. It turned out that all of the patient's organs could be harvested and transplanted.

One research article evaluated the effect of early administration of Levothyroxine before the declaration of brain death on the success of solid organ donation. The researchers used an eight-year retrospective study method. The study included 77 trauma patients who were declared brain dead, given levothyroxine and donated organs. The participants were separated into two groups, those who received levothyroxine before declaration of brain death and those who received it after. The study found that organ procurement rates increased when levothyroxine was given before declaration of brain death. This is applicable to my patient, as he received this

drug after being declared brain dead. Possibly, LifeNet should consider pushing the early administration of this drug in the future (Joseph et al., 2014).

Conclusion

The patient evaluated in this case study was a 22-year-old military officer who endured a fatal self-inflicted gunshot wound to the head. Through writing this paper I learned about the pathophysiology of a traumatic perforating injury and how it related to nursing care. This development of knowledge is certainly applicable to my future nursing career as it guided me to look at how each body system is interrelated in different ways. However, I feel that having my first hands-on experience with taking care of a patient and family in such a tragic situation has taught me other equally as valuable lessons to include how to therapeutically react toward a grieving family.

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Appendix A: Honor Code

"I pledge to support the Honor System of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member of the academic community, it is my responsibility to turn in all suspected violators of the Honor Code. I will report to a hearing if summoned."

Signature: Cortney O'Connors

Appendix B: Rubric

NURS 451 Client Case Study
Grading Criteria

Student: _____ Score: _____

Grading Criteria	Points	Faculty Comments	Points Awarded
Introduction Pt. Overview Scope of paper	 2 1		
Medical Diagnosis Dx for ICU adm. Patho Related S/S	 2 4 4		
Nursing Diagnosis 5 NANDA (1+ psych/soc) Priority with theorist support	 5 10		
Outcomes for top 2 NDX Appropriate for NDX Attainable within timeframe	**#1 #2** 2.5 2.5 2.5 2.5		
Interventions for top 2 NDX Interventions with rationale SOP /Clinical Path Patient/family teaching Critical Thinking Cultural Considerations	**#1 #2** 6 6 2 2 2 2 2 2 3		
Evaluation Progress toward outcomes Additional/alternative plan	**#1 #2** 5 5 1 1		
Conclusion Review of learning	 3		

Grading Criteria	Points	Faculty Comments	Points Awarded
Sources 5+ sources 3+ **primary nursing research** Study results reviewed/applied Study poorly reviewed/applied Research omitted	 1 3 3 3 1 1 1 0 0 0		
APA Format (Cover page, headings, margins, type size) Format conforms to APA Format Format includes 1-3 APA errors Format includes 4-6 APA errors Format includes >6 errors	 3 2 1 0		
APA- References/Reference Page Conform to APA Format Include 1-3 APA errors Include 4-6 APA errors Include >6 APA errors Do not conform to APA format	 4 3 2 1 0		
Writing Style (Grammar, spelling, punctuation, language) Logical, organized, without errors Logical, organized minor errors (<5) Lacks logic/organization **OR** major spelling/grammar/errors (>5) Lacks logic / organization **AND** major spelling / grammar / errors (>5)	 3 2 1 0		

Comments: