Case Study of 44-Year-Old Woman

Student’s name

Institution
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Evaluation of Primary and Secondary Survey

When arriving at the scene, the first step is to check the environment for any possible danger. The undertaking is appropriate to ensure optimal safety of the responders and the patients as well as spectators. Even ANZCOR (2016) recommends the prioritization of safety checks upon arrival at the place of trauma. The second undertaking in the primary survey is to check and examine the breathing of the woman. Blockage of the airways can be disastrous because it causes the suffocation of a victim. As such, it is a prerequisite in emergency response to save the life of a traumatized person. ANZCOR (2016) also recommends the prioritization of airway checkup in the primary survey.

The third step in the primary survey would be the identification of any issues that can lead to further injury to the patient. This step is crucial to ensure that the lying or sitting position of the patient does not worsen bodily injuries and pain. The next step in the primary survey would be to examine the response to tactile and verbal stimuli. The move would involve asking the 44-year-old woman questions and checking her bruised parts. Undertaking the step is essential in verifying the consciousness of the patient and knowing the criticality of her health. Such procedure is crucial in giving an appropriate medical intervention. The next stage of the primary survey would be controlling the bleeding. According to ANZCOR (2016), inhibition of blood can involve physical pressing on a bleeding part to exert pressure. The subsequent measure should include the application of an ice pack on the bruises of the abdomen and the head, to tackle any potential internal bleeding. The next step should involve protecting the patient from the harsh weather condition. The measure is crucial in stabilizing body temperature and functionality of the patient’s organs. It is also essential to reassure the woman of her safety and
possibility to recover soon. Reassurance involves talking, which has therapeutic value to expedite recovery.

The secondary survey of the 44-year-old woman would involve interrogating her about medical history as well as the cause of the injury. Interrogation about the cause of the accident would provide clues as to other body areas likely to have sustained injuries (St John Ambulance, 2015). Questioning about medical history would provide information about allergies and chemical constitution of a new medication to ensure a safe administration of medicine. Body examination through palpation is also crucial in discovering hidden or undetected injuries (St John Ambulance, 2015). This further examination helps medics to avoid injuring traumatized victims more. Careless treatment of a traumatized person can worsen bone injuries.

Even though the prehospital immobilization would be a necessary step, scarce evidence supports its effectiveness and reasonableness. Early research attributed the development of enhanced spinal immobilization with improved neurological results in backbone injuries (McGraw & Strecker-McGraw, 2016). However, such a situation happened because of a scientific evidence. Even now, there is no proper evidence (Class I) demonstrating that backbone immobilization enhances neurological outcomes. The current evidence of the effectiveness of spinal immobilization limits to Class II and III. According to McGraw & Strecker-McGraw (2016), the possibility of high-quality trials in the future is unlikely because of ethical considerations. Rigid backbone immobilization has many risks to patients. First, the approach reduces compelled vital capacity in pediatric and adult populations. Secondly, the method compromises vascular functionality (McGraw & Strecker-McGraw, 2016). Restraint and compression also increase the danger of developing pressure ulcers.
Relevant Pathophysiology

A crash can be a severe occurrence for a human being. A collision can cause multiple injuries that can compromise the overall mechanical, biochemical, and physical functioning of the body. In the case, the 44-year-old woman sustained multiple injuries because of cattle walking over her after the fall. One of the areas with notable injuries was head, she’s got a concussion. Concussion was caused by the cattle having trampled on the woman’s head. The heavy weight of animals increases the possibility of breaking the skull. The trauma caused by the cattle trampling the head could cause internal bleeding in the brain or rupture of blood vessels. The internal bleeding could cause a blood clot in the brain. Intracranial bleeding and a blood clot in the brain can cause a stroke. A blood clot in the brain is manifested in different ways. First, it manifests through seizures that involve incapacitation of a specific body organ. It also manifests through a body weakness. Additionally, impaired vision and lured speech also depict the presence of blood clot in the brain. Such symptoms are present in the 44-year-old woman trampled by cattle. The signs manifested during a helicopter flight to the medical facility for further treatment. At that time, the level of alertness of the patient deteriorated.

The score of the patient in the Glasgow Coma Scale (GCS) was worrying. Glasgow Coma Scale (GCS) is a simplified scoring approach used to describe the level of alertness or consciousness in people after sustaining brain harm. The scale helps to gauge the severity of a brain injury. The test is usual and reliable. It is a tool for specialized physician. The 44-year-old patient managed to get an average score of 12, while the standard point should be 15. Regarding the eyes, verbal and motor systems, the patient scored 3, 4, and 5 respectively. The standard GSC scores considered safe include 4 for the eyes, 5 for verbal system, and 6 for the motor system. According to the GCS scale, an average rating of 8 and below means severe brain injury. A score
of 9-12 depicts moderate brain injury. Mild injury manifests through the score between 13 and 15. As such, the average rating of 12 for the woman means that she sustained a moderate brain injury. Like severe, modest brain damage results typically in prolonged impairments in physical skills, behavioral and emotional functioning, and cognition of thinking skills.

While the Glasgow Coma Scale (GCS) could provide sufficient grounds to suspect brain injury, an insufficient supply of blood oxygen can also lead to unconsciousness (Jain, Teasdale, & Iverson, 2019). In case of the 44-year-old woman, she had a breathing problem during airlifting by a medical helicopter. Labored breathing can be the reason for the losing consciousness because very little amount of oxygen reaches the brain. Even though the paramedics found the airway being clear during the assessment, the labored breathing could attribute to high altitude. Oxygen deficiency due to high altitude can cause mild to severe symptoms. Moderate symptoms of high-altitude sickness include dizziness, sleeping disorders, elevated heart rate, fatigue, and nausea (Jain, Teasdale, & Iverson, 2019). Severe symptoms include difficulty in breathing, chest pain, cough, and disorientation, among others (Cleveland Clinic, 2019). The density of atmospheric oxygen decreases with an increase in height. As altitude increases, the pressure of the air drops and gas molecules separate wider. As a result, people at such heights may have to breathe rapidly to compensate for the deficit in oxygen supply (Cleveland Clinic, 2019). There is a possibility that the unconsciousness of the patient is attributed to the low amount of oxygen and not brain damage. Indeed, the examination during the helicopter flight showed that oxygen saturation dropped to 90%. In this case, it would be proper to monitor the patient for GCS performance upon landing.

The patient also suffered bruises on the back and abdomen that caused her intense pain. For bruises to develop, the blood vessels, especially, capillaries near the skin surface are likely to
rupture. The severe pain experienced by the patient could mean that bruises were deep into the skin and caused widespread pain. Left untreated, an injury can stimulate the formation of a purse that may ultimately lead to an open wound. Open wounds are exposed to microorganism infection (Cleveland Clinic, 2016). The difficulty to move the right arm could be due to various reasons. First, the woman could have suffered bone dislocation that complicated motion coordination besides being painful. In the case of a bone dislocation, the woman required careful treatment because roughness could worsen the fracture. Secondly, the muscles, veins, or the skin around the right arm might have suffered severe bruises. Sometimes, bruises may associate with excruciating pain that can make organ movement painful and uncomfortable.

**Pharmacokinetic and Pharmacodynamics**

Pharmacokinetics and pharmacodynamics are essential concepts in the study of drug actions and the body of living organisms. Pharmacodynamics refers to the study of the effects of drugs on the human body. Pharmacodynamics involves things like chemical interactions, post-receptor effects, and receptor binding. Pharmacokinetic refers to the action or response of a human body to drugs. Pharmacokinetics may include activities like metabolism, excretion, distribution, and absorption. When treating the 44-year-old woman, the paramedics injected the patient with penthrane or methoxyflurane to remedy pain.

**Pharmacodynamic of Penthrane/ Methoxyflurane**

Penthrane is an analgesic drug that helps in relieving pain and suffering in patients. It helps in the immobilization of patients with trauma and ensuring safety for operators. The action of methoxyflurane on the human circulatory system is similar to that of diethyl ether. Methoxyflurane causes an intermediate decline in blood pressure with limited changes in the rate
of heart activity (Porter, Dayan, Dickerson, & Middleton, 2018). The drug has an insignificant effect on epinephrine, norepinephrine, and blood sugar.

Methoxyflurane is an inhalation anesthetic applied in inducing as well as maintaining anesthesia. The drug causes the relaxation of muscles and reduces the sensitivity of pain through alteration of tissue excitability. It achieves the action by decreasing the gap-junction-mediated cell-cell coupling. The substance compromises neurotransmitter production and reuptake around the postsynaptic terminals. The agent also interferes with ionic conductance after the activation of receptors by neurotransmitters and disrupting neuronal transfer (Galen Limited, 2018). It also works by altering the operation of channels underlying the potential of action. Methoxyflurane decreases the junctional conductance by reducing the duration of opening of gap-junction channel and increasing its closing time. It also activates calcium-dependent ATPase at the sarcoplasmic reticulum through enhancement of lipid membrane fluidity (National Cancer Institute, n.d). Methoxyflurane also binds the NADH dehydrogenase and D subunit in the ATP synthase. The drug also attaches to GABA receptor, glycine receptor, glutamate receptor, and calcium-activated potassium channel (Galen Limited, 2018).

Methoxyflurane has negligible effects on pulmonary circulation and does not expose the human heart to the risk of cardiac dysrhythmias. Methoxyflurane has adverse action on the lungs of patients. The substance has a significant depressive effect on the respiratory system. The drug cause dose-dependent decline in a minute and tidal volumes. The depressed respiratory activity manifests through carbon dioxide retention with a concomitant decrease in the pH of the artery when the anesthetized individuals start to breathe spontaneously. Methoxyflurane has an insignificant effect on the gastrointestinal system. In the central nervous system, methoxyflurane presents as a “positive allosteric modulator” of GABA as well as glycine receptors (Galen
Methoxyflurane connects the mechanism of action to alcohol, which causes general anesthesia.

Even though the high solubility is undesirable, the property makes methoxyflurane instrumental in some conditions. Since it persists in the fatty tissues of human bodies for an extended time, methoxyflurane guarantees analgesia and sedation even after the operation.

**Pharmacokinetics of Penthrane**

Penthrane is nonflammable and unstable halogenated ether. It has an unusual low vapor pressure and evaporates readily (Porter et al., 2018). This feature restricts the applicability for inhalation anesthesia, especially when it is difficult to achieve a therapeutic vapor saturation. Once administered, penthrane is highly soluble in fats and blood. The coefficient of gas partition for the drug is high, which slows induction, rate of change of anesthetic depth, and recovery. As far as absorption is concerned, methoxyflurane has partition coefficients of 13 for blood/gas and 825 for oil/gas (Porter et al., 2018). Additionally, penthrane is highly soluble in rubber and can dissolve in some parts of the breathing structure. The agent reaches the lungs as a vapor and undergoes rapid transportation in the blood, that causes a fast onset of analgesic effect. Since methoxyflurane has a high partition coefficient of 825 in oil/gas, it is lipophilic and has a high propensity to dissolves in fatty deposits where it establishes a reservoir for slow release in the future.

Penthrane goes through extended hepatic biotransformation, and the human body metabolizes about 50 percent of the agent inhaled. The agent undergoes metabolism by o-demethylation and dichlorination in the human liver. Enzymes CYP 450 (specifically CYP 2A6 and CYP 2E1) mediate the metabolism process (National Cancer Institute, n.d). The primary
metabolites include oxalic acid, dichloroacetic acid, and fluoride. It also undergoes substantial metabolism to produce fluoride in the kidney. The body excretes about 60% of inhaled methoxyflurane in urine as fluoride, oxalic acid, and organic fluorine (Porter et al., 2018). The body eliminates the remaining 40% traces of the agent as carbon dioxide or in unaltered form.

**Ongoing Clinical Management**

The reason for the admission of the 44-year-old woman in the emergency department is attributed to her deteriorating consciousness. Within a few minutes after arrival in the emergency department, the primary care for patient was resuscitation. This procedure was essential to establishing the respiratory system of the woman. The deteriorating consciousness of the patient could be due to the higher altitude effect that limits the amount of oxygen flowing into the body. After resuscitation, it would be easier for medics to eliminate suspicions. It is worth remembering that brain injury and the methoxyflurane are among the possible causes of the currently deteriorating health condition. In that, resuscitation would help in determining the impact of high-altitude flight on the consciousness of the patient. Resuscitating the woman would also facilitate the neutralization of methoxyflurane and stabilize the patient. Once the levels of methoxyflurane decline, it would be possible to determine the cause of unconsciousness.
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