CE 1.5 ANCC Contact Hours

Caring for Trauma Patients With Coexisting Heart Failure

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ABSTRACT

The coexisting conditions of traumatic injury coupled with a comorbid condition such as heart failure create a complex scenario for the trauma nurse to manage. Initial care of the trauma patient includes following the Advanced Trauma Life Support guidelines and managing the airway, breathing, and circulation (ABC) of the patient. Once the airway is secure and breathing is managed, the team addresses circulation. At this point in the patient's care, the team typically does not know which, if any, comorbid conditions exist. Managing circulation for a hypotensive or hypoperfused patient will most likely include 1–2 L of crystalloid solution being given intravenously. Although most patients can tolerate this fluid volume challenge, excess volume can be difficult for a patient with heart failure. This article describes the monitoring and management techniques that are recommended for patients presenting with trauma and the comorbid condition of heart failure.

Key Words

Heart failure, Nursing, Nursing management, Trauma, Volume management

Trauma accounts for approximately 41 million emergency department visits annually (Nationaltraumainstitute.org). Heart failure (HF) affects approximately 5.7 million people in the United States (Centers for Disease Control and Prevention [CDC], 2016). Among those with traumatic injuries requiring hospitalization, approximately 3% also have coexisting HF (Prin & Li, 2016). The complex nature of trauma, coupled with a comorbid condition such as HF, can make the care of such patients very difficult. The fact that during the initial management of trauma, health care providers often are not aware of comorbid conditions further complicates the care management of the trauma patient. This article reviews the literature regarding trauma care in the United States, as well information regarding HF, to increase the nurses' understanding of caring for this complex combination of conditions.

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TRAUMA

Traumatic injuries are a unique entity due to the fact that they can affect any person, regardless of age, gender, or socioeconomic status. Over the past two decades, deaths from injury have been increasing at more than double the rate of the population growth. Rhee et al. (2014) found that although the U.S. population increased by 9.7% from 2000 to 2010, the number of deaths from injuries increased by almost 23%. During this time, injuries remained the greatest cause of life years lost.

Injuries also continue to be one of the leading causes of emergency department visits across the United States. In 2014, the CDC credited injuries for 26.9 million emergency department visits, 2.5 million hospital admissions, and 199,800 deaths (CDC, 2017). Unintentional injuries were the fourth leading cause of death for all Americans and the leading cause of death for people younger than 45 years (Kochanek, Murphy, Xu, & Tejada-Vera, 2016). Motor vehicle crashes (MVCs) are credited as the leading cause of death for unintentional injuries. The CDC listed MVCs as the primary cause of injury death for those aged 5–24 years and the second leading cause of death for those 25 years and older. In 2014, a total of 7,260 people between the ages of 2 and 24 years (22% of all MVC fatalities) and 26,115 people who were 25 years and older (77% of the MVC fatalities) lost their lives as a result of an MVC. For Americans 65 years and older, unintentional falls were credited as the number one cause of unintentional injury death, claiming 27,044 lives (85% of unintentional fall fatalities) (CDC, 2017).

Fortunately, for those affected, health care providers' ability to decrease mortality rates has also increased. A greater understanding of injuries and training programs aimed at standardizing care for injured patients have allowed lifesaving interventions to be implemented the moment providers first make contact with a patient. Early interventions, coupled with higher levels of care available at dedicated trauma centers, give these patients the greatest chances of survival. New research continues to suggest a strong correlation between early access to dedicated trauma centers and decreases in mortality (Branas et al., 2005). The next step in trauma care is figuring out new ways to increase all American's access to these lifesaving services.

HEART FAILURE

Heart failure is defined as the inability of the ventricles to fill or eject blood. Symptoms of HF include dyspnea and fatigue, exercise intolerance, and fluid retention (Yancy et al., 2013). Causes of HF include disorders of the heart muscle, for example, cardiomyopathy, heart valves, or great vessels, or from certain metabolic abnormalities, but most patients with HF have symptoms due to impaired left ventricular myocardial function (Owan & Redfield, 2005). In addition, hypertension and coronary artery disease are the greatest risk factors for the development of HF (Capriotti & Frizzell, 2016).

In the United States, HF is reaching epidemic proportions, with 5.9 million people diagnosed with HF and more than 650,000 new cases diagnosed annually. Currently, one in nine deaths is related to HF (CDC, 2016). The lifetime risk of developing HF is 20% for Americans 40 years or older (Diousse, Driver, & Gaziano, 2009). Heart failure is the most common cause of hospitalizations among Medicare beneficiaries (Centers for Medicare & Medicaid Services, 2014). Heart failure is categorized as either HF*p*EF (preserved ejection fraction) or HF*r*EF (reduced ejection fraction). Ejection fraction is the measurement of the percentage of blood leaving the heart during systole. Patients with HF*r*EF are usually treated with β-blockers, angiotensin-converting enzyme (ACE) inhibitors, and nitrates. If however the patient is intolerant to ACE inhibitors, treatment may be changed to an angiotensin receptor blocker or an angiotensin receptor neprilysin inhibitor (Yancy et al., 2017). Patients with HF*p*EF are treated with the same regimen as described earlier to control blood pressure (BP), and also diuretics are employed to help prevent fluid overload. Routine care of patients with HF consists of BP control, daily weight monitoring, and fluid restriction.

Monitoring of HF can include measurement of natriuretic peptides (NPs), including B-type natriuretic peptide (BNP), and N-terminal probrain natriuretic peptide (NT-proBNP) (Roberts et al., 2015). Measurement of either BNP or NTproBNP in the acute care setting can assist health care providers in identifying the presence of HF. Below normal ranges of BNP and NTproBNP are extremely sensitive indicators at ruling out HF, and higher values require confirmatory testing with cardiac imaging (Roberts et al., 2015).

TRAUMA AND COEXISTING HEART FAILURE

Lifesaving interventions for the trauma patient can be complicated by the presence of preexisting comorbidities. Bell and Zarzaur (2015) identified several preexisting conditions that significantly increased the risk of death after a traumatic injury. The top contributors were congestive heart failure, previous myocardial infarction, end-stage renal disease, and diabetes.

Often in trauma situations, a patient's full medical history is not immediately available to providers during the initial resuscitation. Treatment of traumatic injury often requires the administration of large amounts of colloids, crystalloids, and blood products necessary to correct hypotension and ensure end-organ perfusion and oxygenation. The American College of Surgeons (ACS) recommends in its Advanced Trauma Life Support (ATLS) courses that an initial fluid bolus of 1–2 L of isotonic crystalloids is given for the treatment of the hypotensive patient (ATLS Subcommittee, American College of Surgeons' Committee on Trauma, & International ATLS working group, 2013). Because large fluid boluses are contraindicated in two out of the four comorbidities identified by Bell and Zarzaur, it is not surprising that patients sensitive to fluid volumes have increased mortality rates after treatment of a traumatic injury. It is up to trauma providers to weigh the risks of the immediate life-threatening injuries against the potential complications that may arise from exacerbating preexisting diseases.

According to the ACS ATLS guidelines, the elderly should be considered as a special population when they experience trauma because they may have decreased physiological reserve and chronic conditions that may impair their ability to respond to their injuries. Comorbidities, such as HF, are more common in the elderly and may lead to poor outcomes when coupled with a traumatic injury. Also, the polypharmacy that the elderly often take on a daily basis may alter their response to the injury or treatment attempts. The ACS encourages prompt, aggressive resuscitation and early recognition of comorbid conditions as well as medication use to improve outcomes (ACS, 2012).

Initial management of the trauma patient is directed by the ATLS guidelines (ACS, 2012), beginning with the primary survey. According to this guideline, trauma care providers will follow the ABCDE method of assessment and treatment, which stands for Airway, Breathing, Circulation, Disability, and Exposure/Environment. The key component for discussion in this article regarding trauma and HF is C, circulation.

Once the airway and breathing of the patient have been managed, the health care providers, including nurses, must assess the cardiovascular system. Heart rate (HR) and BP are the most primitive measures of this category (Dries & Geibel, 2017), allowing the trauma team to identify signs of hemorrhage or cardiac depression. Additional measures of circulation include capillary refill, jugular vein distention or collapse, strength of peripheral pulses, skin color, and temperature indicating adequate or inadequate perfusion (Thim, Krarup, Grove, Rohde, &

Lofgren, 2012). Urine output (UO) should be assessed as a method of measuring the results of volume replacement and renal perfusion.

Imagine that you are caring for a patient who is a 76-year-old female patient who was in a motor vehicle collision, struck head-on at approximately 55 miles per hour. The airbag deployed, and she has seatbelt bruising across her chest and abdomen. She presented with shallow respirations and was emergently intubated. Once intubated and adequately ventilated, you note her HR is 100 beats per minute, radial pulses are 1+ bilateral, skin is cool, and her BP is 90/56 mmHg. As a trauma nurse, you know that the elderly may not be able to increase their HR in response to hypovolemia or hypoperfusion and therefore even though her HR is on the upper end of normal, you suspect hypovolemia based on her other assessment findings of BP, cool skin, and weak pulses (ACS, 2012). At this point, you are performing her primary survey and therefore do not know of any comorbid conditions that she may have.

With the information given, the team will likely focus on improving the patient's perfusion status. Increasing her BP should improve the strength of her pulses, improve her skin perfusion, and lower her HR (ACS, 2012). Fluid volume replacement will be the initial therapy to improve her perfusion and circulatory status. ATLS guidelines suggest that 1–2 L of warmed isotonic fluid may be required as an initial treatment (ACS, 2012). Being that this is the primary assessment phase, the only method likely to assess the effects of the volume would be the changes in HR, BP, pulses, skin temperature, and UO via a urinary catheter (0.5–1 ml/kg·hr). In addition, the nurse can monitor pulse pressure, with a narrowing pulse pressure suggesting hypovolemic shock (ACS, 2012). Given that there may be continuation of bleeding or volume loss, the resuscitation with volume replacement will be required, with ongoing monitoring of the vascular status as described earlier. As you may imagine, this method of resuscitation is effective and lifesaving, however, can result in over- or underresuscitation of the trauma patient.

Continued fluid resuscitation is based upon the classification of shock, Levels I–IV, and the patient's response to initial attempts at fluid management. No or minimal response to fluid resuscitation would suggest a need for surgical or angiographic repair the source of bleeding. Superficial wound bleeding should be managed with direct pressure (ACS, 2012). The goal is to restore end-organ perfusion, which is initially done with volume replacement; however, excessive fluid resuscitation can exacerbate coagulopathy, acidosis, and hypothermia (ACS, 2012). To avoid this dangerous triad, careful volume replacement and reassessment must be done.

Normal UO implies adequate renal blood flow, indicating there is end-organ perfusion to the kidney. Additional assessment of perfusion can include skin temperature, capillary refill, and more advanced monitoring such as peripheral perfusion index and forearm-to-fingertip skin temperature gradient (Van Genderen et al., 2014). Patients requiring large/massive transfusion should be balanced with packed red blood cells, plasma, and platelets, minimizing massive amounts of crystalloids (ACS, 2012). Nurses should be aware that increased BP does not equal increased cardiac output and be sure to monitor end-organ perfusion. For example, the use of vasopressors may increase BP, which increases systemic vascular resistance, and the heart has to work harder against the increased pressure. In this case, there will be increased BP without increased cardiac output, and end organs such as the kidney may be underperfused. An additional consideration, especially with elderly patients, is that in cases of chronic hypertension, trauma patients may appear to the team to be normotensive; however, if their body has adapted to being in a hypertensive state, they may be underperfused at what appears to be a normal BP. Thus, BP should not be used alone as an indication of perfusion.

ATLS guidelines suggest that elderly trauma patients may be ideal candidates for invasive monitoring of their cardiovascular status (ACS, 2012). Once stable, having access to measures such as central venous pressure, cardiac output, stroke volume, and pulmonary artery wedge pressures may provide health care providers with information needed to determine whether the patient is adequately volume resuscitated or fluid volume overloaded.

Elderly patients may have less of a response to the increased catecholamines and volume depletion from long-term diuretic use. Likewise, the pretrauma use of β-blockers may limit the ability to become tachycardic. For these reasons, with elderly trauma patients, health care providers may want to use invasive monitoring to tailor volume resuscitation (ACS, 2012). Central venous pressure (CVP), a measure of right atrial pressure, can be used to monitor fluid therapy; however, the nurse should be aware that this measure can be falsely elevated with chronic obstructive pulmonary disease, generalized vasoconstriction, or rapid fluid replacement. Small rise in CVP with fluid therapy means more volume expansion is needed. Monitoring response to volume infusion and trends in CVP is recommended as opposed to trying to achieve any one CVP number as a goal (Gottlieb & Hunter, 2016).

Additional measures that may be helpful in guiding the resuscitation of the trauma patient include blood lactate levels (Andersen et al., 2013). The pathophysiology of lactate production is complex. For the trauma patient, lactate is produced during states of hypoperfusion and is thus a measurement of shock states. Lactate has been found to be a more reliable predictor of shock than traditional vital signs in elderly trauma patients (London, 2011). Lactate levels should be measured across time to evaluate not just the presence of, but also the ability to clear, the substance (Andersen et al., 2013).

Increased circulatory volume in a trauma patient with HF can impact the cardiac and respiratory systems. The heart will have to work harder to circulate the additional volume, and if unable to do so, volume will back up into the lungs, causing pulmonary congestion. Diuretics may be useful for removal of excess water; however, they should be used with caution in the trauma patient so as not to cause the side effect of hypovolemia (Pellicori, Kaur, & Clark, 2015).

ACE inhibitors are often used in patients with HF with reduced systolic function, as they promote diuresis and the renal excretion of sodium (Pellicori et al., 2015). By this mechanism, ACE inhibitors decrease circulating blood volume and BP. For trauma patients, if they are fluid overloaded from their initial resuscitation, the benefits of an ACE inhibitor may be helpful; however, if BP is lowered too much, organ perfusion could be impacted.

Laboratory studies to monitor volume status for patients with HF include NPs, and NTproBNP. These laboratory values measure stretch of the myocardium and are a way to monitor fluid status in patients with HF. Serial measurements of NPs in the hospitalized trauma patient with HF may be a helpful adjunct to their management plan (Pellicori et al., 2015).

Nurses can assess fluid volume overload by monitoring intake/output, daily weights, signs of edema, jugular venous distention, and lung sounds (Albert, 2012). In cases of extreme fluid volume overload or fluid volume shifting, methods of volume reduction such as diuretics can be tried; however, if the volume overload is causing cardiovascular problems, then continuous renal replacement therapy (CRRT) could be considered (Granado & Mehta, 2016). Several modalities of CRRT are available, and the decision regarding the specific modality requires careful consideration of the patient condition, which is beyond the scope of this article. Regardless of the modality, the goal for the trauma patient with HF is to very slowly remove excess fluid while monitoring the patient's response to fluid shifting (Granado & Mehta, 2016).

CONCLUSION

Given the aging population, trauma nurses are certain to find themselves caring for patients with the coexisting condition of HF. To save the life of the injured trauma patient, the ABC must be followed, which oftentimes include aggressive fluid resuscitation. Nurses can use available tools such as vital signs, UO, skin temperature, laboratory values such as lactate, and advanced monitoring when available to adequately resuscitate while reducing the likelihood of fluid volume overload. If the patient with HF becomes fluid overloaded, the traditional HF treatments of diuretics and ACE inhibitors may be helpful; in more extreme circumstances, CRRT may be needed. Nurses, being the eyes and the ears at the bedside, are key in monitoring and treating the volume needs of the trauma population.

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