Beyond the Basics: Trauma Assessment

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The ABCs of trauma assessment-airway, breathing/oxygenation and circulation-represent the first steps in determining the extent of injury and patient care priorities; however, other factors must also be considered to provide effective and timely care. Identification of immediate life threats is of paramount importance to the EMS provider. The ability to accurately identify life threats may be the difference not only between life and death, but also between a patient leading a normal life and one with long-term disabilities. Aggressive assessment and management of trauma patients may aid in preventing death or disability.

General Impression

Form a general impression as you enter the scene, typically prior to any physical contact with the patient. Seasoned EMS providers are often able to identify "sick" patients and gauge the severity of their conditions or injuries during the general impression, which may also set the pace of emergency care and determine the need for rapid transport.

Age is an important consideration when assessing a trauma patient. The elderly and young children are more prone to suffering severe consequences from certain types of trauma. Comorbid factors in the elderly, such as significant atherosclerotic heart and vessel disease, congestive trauma and certain medications, can play a major role in helping providers understand the presentation of unusual signs and symptoms and progression of the condition, and in determining the severity. For example, an elderly patient who is taking a beta-blocker or calcium channel blocker may not develop tachycardia in response to severe blood loss. If not clearly understood, this may lead to a missed field impression and delay in treatment and transport. Another example is the patient taking Coumadin for chronic atrial fibrillation, who may bleed heavily from wounds that you would expect to clot easily with limited direct pressure.

Gender may be a significant consideration with trauma to the pelvis and abdomen in the pregnant patient. Physiologic changes may alter her presentation when in hypovolemic shock. The pregnant patient has a tendency to become more severely hypovolemic before showing the typical signs and symptoms of hemorrhage.

Patients are usually categorized as either medical or trauma during the scene size-up and general impression. Until the condition is identified or the possibility of spine injury is ruled out, manual in-line spinal stabilization must be established and maintained.

Mechanism of Injury

Trauma results from the transfer of energy in a quantity sufficient to cause damage at the cellular level. Kinetic, thermal, electrical and radiation are examples of sources of energy that may cause injury. Kinetic energy is the most frequent source of injury seen by EMS.

Mechanism of injury describes the process of assessment related to how kinetic energy was transmitted through the body and which organ systems were most likely affected. The most important basic concepts to keep in mind when assessing mechanism of injury are: 1) the anatomy of the area affected by trauma; and 2) Newton's first law of motion, which states that "An object at rest will remain at rest, and an object in motion will remain in motion until acted upon by an external force."

Monitoring the patient's neurological status (pupils and grip strength) is an important part of assessment.

Newton's first law of physics explains the physiology of acceleration/deceleration injuries as follows: If a patient is traveling in a car at 60 mph and suddenly stops when the car impacts a tree, the victim's body will remain moving at 60 mph until it is acted upon by an "external force," such as the steering wheel, windshield, seat belt or air bag. The patient's brain, heart, liver, lungs and other internal organs will do the same, continuing at the same speed as the vehicle until they strike the inside of the skull, or thoracic and abdominal wall. As evidence of this concept, the frontal and temporal lobes of the brain are most often injured in this type of impact. The brain is injured as it rides over the bony ridges found on the inner surface of the moving skull. This acceleration/deceleration injury pattern is commonly referred to as the three-collision concept.

Airway

Airway management in the trauma patient may at times be problematic. Bleeding; fractures to the mandible, maxilla and face; soft tissue trauma; swelling; and bone fragments may compromise the trauma patient's airway. Lack of an effective airway may make all other emergency care futile. Familiarity with upper airway anatomy is essential to providing optimal airway management.

There are marked anatomic differences in the airway from person to person. Thus, when performing airway procedures, it is not uncommon to experience a variety of airway management difficulties in various patients. One purpose of airway assessment is to identify patients with anatomical features that are more predisposed to complications. Once a complication is identified, a plan can be formulated to proactively manage the airway.

The airway can initially be evaluated using a series of mnemonics as discussed in the Manual of Emergency Airway Management and The Difficult Airway Course-EM:

MOANS

1. **M**ask seal
2. **O**besity/Obstruction
3. **A**ge (greater than 55)
4. **N**o teeth
5. **S**tiffness

LEMON

1. **L**ook externally
2. **E**valuate 3-3-2
3. **M**allampati scale
4. **O**bstructions
5. **N**eck mobility

For an in-depth discussion of these mnemonics, see Beyond the Basics: Airway Assessment on page 85 in the January 2006 issue of EMS Magazine.

Glasgow Coma Scale

The GCS is comprised of three assessment criteria: best eye response, best verbal response and best motor response. They are as follows:

The best eye response
1 no eye opening
2 eye opening to pain
3 eye opening to verbal command
4 eyes opening spontaneously

The best verbal response
1 no verbal response
2 incomprehensible sounds
3 inappropriate words
4 confused response
5 clear, orientated response

The best motor response
1 no motor response
2 extensions to pain
3 flexion to pain
4 withdrawal from pain
5 localizing pain
6 obeying commands

The score should be broken down into its core parts. For example, if the patient opens his eyes spontaneously (score of four), responds verbally with inappropriate words (score of three) and responds by localizing pain (score of five), the overall Glasgow Coma Score should be presented as E4-V3-M5. Although the score is most effective when broken down into parts, the most common practice is to communicate an overall score, as in the previous example, where the GCS is 12. It is important to note that the lowest score possible is 3; a dead patient would have a GCS of 3.

Glasgow Coma Scale

Breathing and Oxygenation

Look at the patient's general state to assess oxygenation. If the patient appears anxious, agitated or irritable, it suggests hypoxia; confusion may indicate carbon dioxide retention. Both respiratory rate and tidal volume must be determined when assessing breathing. It is not uncommon for the trauma patient to have increased respiratory rate and effort from an increase in acidosis or in response to pain. A greatly increased rate of respirations suggests respiratory distress.

In the event of a thoracic injury, the patient may present with shallow, rapid respirations, often related to pain on inspiration. A decreased respiratory rate is usually indicative of inadequate respiratory effort secondary to a decreasing level of consciousness or a possible head injury. In addition to rate of ventilation, tidal volume or depth of ventilation must also be assessed. The simplest ways to determine effective ventilatory tidal volume include:

1. Look for adequate chest rise
2. Listen for strong, equal breath sounds
3. Controlled, near-normal ventilatory rate

Auscultating lung sounds should ideally be conducted in a relatively quiet environment. Lung sounds should be auscultated in the midaxillary (below the armpits) region to ensure that referred breath sounds (sounds that can be transmitted from one side of the chest to another) are not heard. Anterior auscultation will not evaluate the bases of the lungs, so it may be helpful to auscultate the posterior thorax during the log roll to a backboard. Do not log roll the patient again to auscultate posterior breath sounds once he is secured or placed on the backboard, as this may jeopardize spinal stabilization.

Pulse Oximetry

While pulse oximetry will reflect how much hemoglobin is bound with an oxygen molecule, it won't provide information on what type of oxygen molecule is bound to the hemoglobin. In other words, it will not reflect whether the hemoglobin is saturated with oxygen (O2) only, or, in the case of the burn patient, how much is bound with carbon monoxide (CO). Pulse oximetry readings can be used to monitor and document saturation readings over time and to make a possible correlation to improvements after interventions or worsening of the patient's condition. Use caution when pulse oximetry is used for anything other than trending patient compensation or response to therapy.

Capnography

Although useful in all forms, capnography is most useful when quantitative and graphic, as in continuous waveform capnography. This form of capnography is most beneficial because it allows for continuous airway and ventilation monitoring. Clinical studies have proved that end-tidal CO2 levels are predictive of cardiac output. As such, it can be deduced that since ETCO2 can determine cardiac output, it should be used in all compromised patients. Although most EMS providers are accustomed to monitoring ETCO2 in intubated patients, there are also devices that will record ETCO2 in the non-intubated patient, and these can be of great benefit to trauma patient assessment.

Circulation

A patient's mental status may provide clues to perfusion deficits even prior to checking a pulse. This information may be obtained during the general impression, which is typically the first phase of the initial assessment. Regardless of what information is gleaned from the general impression, a pulse must be assessed. Palpating a pulse should be accomplished at the radial and carotid or femoral artery simultaneously. In the trauma patient, there may be a variation in pulse amplitude (strength) at different pulse points, indicating a perfusion disturbance and shock state.

Capillary refill time is most accurate in determining the hydration status in children. Healthy children do not have the peripheral vascular disease (PVD) found in adults, and, as a result, capillary blood flow is highly responsive in children. In addition to PVD and environmental factors like cold, ambient temperatures can affect capillary refill times. In adults and children alike, capillary refill should not be used as a reliable assessment of perfusion status. It should be used as only one of many indicators of a shock state. Shock cannot be determined by a poor capillary refill alone. It must be viewed and considered globally with other signs and symptoms.

Blood Pressure

Systolic blood pressure indicates much more than the "heart at work." Likewise, diastolic blood pressure is much more than the "heart at rest." Systolic blood pressure is a measure of cardiac output, which, simply put, is a measure of left ventricular function. Diastolic blood pressure is measured during the relaxation phase of the heart; however, it is a direct measure of resistance in the vessels that is related to vessel size from constriction and dilation. As blood is lost, the volume entering the left ventricle prior to its contraction is reduced. This will cause a reduction in cardiac output, which is reflected as a decrease in systolic blood pressure. As blood is lost, the body attempts to compensate by constricting the peripheral vessels. The decrease in blood vessel size causes an increase in vessel resistance. The increase in resistance is seen as an increase or stabilization of diastolic blood pressure. Thus, systolic blood pressure is falling as the diastolic blood pressure increases or remains unchanged. The difference between systolic and diastolic blood pressure is known as pulse pressure. The decrease in difference between the two pressures is known as a narrow pulse pressure. A narrow pulse pressure is one indication of hemorrhagic shock in the trauma patient.

Disability

Assessment of the trauma patient's mental status can often be accomplished with the AVPU scale. The goal of mental status assessment in the prehospital environment is to determine the severity of mental status deficit. The AVPU scale determines the patient's gross mental state by gauging his eye opening and best response to stimuli.

1. Is the patient awake and alert?
2. Does the patient respond to verbal stimulus?
3. Does the patient respond to painful stimulus?
4. Is the patient unresponsive to any form of stimulus?

As an example, the head trauma patient who is completely unresponsive, or a "U" on the AVPU scale, may have significant injury to both hemispheres of the brain or to the nerve pathways within the brain to the ascending reticular activating system (the wake/sleep component), or both. Inversely, the patient with some degree of responsiveness, either verbal or painful, will still have effective nerve transmission within the nerve pathways and the brain. It is important to realize that not all trauma patients with altered mental states have head trauma. Altered mental status may be caused by hypoglycemia, toxic exposures, metabolic abnormalities or structural abnormalities, among other etiologies.

When performing your mental status assessment, attempt to elicit a painful stimuli response at various points of the patient's body before determining that he is unresponsive. If the patient has a spinal injury, the nerves below the level of the injury will not likely respond to stimuli and the patient may not respond. Check for stimulus at various points of the body, including the lower and upper extremities, trunk and the patient's head. Be sure to assess for both central and peripheral painful stimulus response. Keep in mind that applying a peripheral pain stimulus may cause a reflex arc to produce movement in the extremity, even though the impulse never reached the brain for interpretation. This response will not be seen when applying a central painful stimulus, such as a trapezius pinch.

The Glasgow Coma Scale (GCS) is an objective tool that can be used to assess the level of consciousness in a trauma patient. The GCS provides a method for universally communicating injury severity to the entire trauma team. The single greatest value of assessing the GCS is that it provides a baseline assessment of the patient's condition, which can be used as a trending tool to evaluate the rate of cerebral function or dysfunction over a period of time. A GCS of less than 13 indicates a serious injury; a GCS of less than 7 indicates a profound injury.

Exposure

A trauma assessment cannot be completely effective when the body is covered by clothing. During the primary assessment, remove the patient's clothing to ensure that immediate life threats are identified.

Summary

Your patient assessment, including a history and, more important, in the trauma patient, the physical exam, and the mechanism of injury will determine treatment and transport priorities. The No. 1 consideration in managing the trauma patient is to establish and maintain an effective airway, ventilation, oxygenation and circulation. Recognizing that the trauma patient needs immediate definitive intervention, an on-scene time of less than 10 minutes is desirable. When determining transport priorities, the EMS provider must decide if delaying transport to perform a procedure is necessary to sustain the patient throughout transport. If it is not a critical procedure, it should be performed en route to the trauma center. Due to the extent of injuries, some trauma patients will die regardless of your most proficient assessment and emergency care.

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