ATLS UPDATE: CASE STUDIES IN TRAUMA

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OVERVIEW

Trauma is the leading cause of death in the first four decades of life and the third leading of all causes of mortality. Furthermore, for every person killed, three others are permanently disabled. Annual trauma-related costs in the United States are in excess of $400 billion. Advanced Trauma Life Support (ATLS) is a model of trauma care endorsed by the American College of Surgeons Committee on Trauma. The first courses were conducted in 1980 with the goal of disseminating a "safe, reliable method for the immediate management of the injured patient." The latest edition of this document, the sixth, was released in 1997. The seventh edition is expected in June 2002. International ATLS programs began in 1987. Currently, 29 countries are authorized to provide ATLS training. More than 225,000 doctors have been certified worldwide.

CASE ONE

History

A 22 year-old male was the unrestrained driver in a road traffic accident (RTA) when his vehicle collided head-on with St. James's Gate. A strong odor of alcohol exudes from the patient. He has an obvious large scalp laceration and is combative. His Glasgow Coma Score (GCS) is 10. The patient's vital signs are HR 105, BP 110/75, RR 24.

Initial Management

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During transport to the emergency department (ED), emergency medical staff (EMS) initiate resuscitation efforts: The patient is placed in a cervical collar and full spinal immobilization. He is provided with high-flow supplemental oxygen. Two large-bore intravenous lines are secured.

Primary Survey

On arrival to the ED, emergency staff triage the patient immediately to the resuscitation area. The patient promptly begins to vomit.

Airway

An awake and alert patient with normal voice quality who answers questions appropriately has no immediate airway problem. Still, regardless of the results of the initial airway evaluation, all trauma patients require regular reassessment of their airway status. This patient's airway is in jeopardy. He has evidence of head injury, a GCS of 10, and is vomiting. His airway needs to be protected with a cuffed endotracheal tube (ETT) secured in the trachea. Intubating this patient will decrease the chance of contaminating his lung with vomit, blood, and secretions. This is important because aspiration and contamination of the airways could complicate his recovery. The first step in protecting this patient's airway is to logroll him onto his side, maintaining full spinal immobilization. Spinal precautions are essential because 1% of all trauma patients have a cervical spine injury. This figure increases to 5% in those with head-injury and 8% in those with a GCS of 8 or less. Next, the patient should be intubated using the rapid sequence technique.

Indications For Definitive Airway in Trauma

Besides apnea, ventilatory failure, and refractory hypoxia, other indications for a definitive airway in trauma are as follows:

1. Massive facial injury
2. Head injury with GCS < 8
3. Multiple trauma with persistent hypotension
4. Thermal injury to the airway
5. Penetrating injury to the neck (zones II or III)
6. Blunt injury to the neck with expanding hematoma or voice change

Rapid Sequence Intubation (RSI)

Rapid sequence intubation employs the use of neuromuscular blockade and sedative-hypnotics to facilitate intubation. The contraindications for RSI are if the oropharynx is obstructed so that the jaw cannot be opened or if the patient cannot be ventilated using a bag-valve mask (BVM). Rapid sequence intubation requires attention to the six Ps.

1. Planning
2. Pre-oxygenation

3. Pre-medication
4. Paralytics
5. Placement of ETT
6. Post-procedure management

Planning

A surgical airway may be necessary if the patient cannot be intubated. Preparations should be made for this possibility.

Pre-oxygenation

In the spontaneously breathing patient, adequate pre-oxygenation is accomplished by a few minutes of 100% oxygen by facemask. This removes nitrogen from the lungs and creates a reservoir of pure oxygen helping the patient to better tolerate a brief period of apnea during the intubation process. The patient with minimal respiratory efforts requires BVM ventilation with the application of cricoid pressure, Sellick's maneuver.

Pre-medication

Children less than 6 years old, require atropine to blunt the vagal response to laryngoscopy. The dose is 0.02 mg/kg with a minimum dose of 0.1 mg and a maximum of 0.5 mg. In head injured patients, lidocaine is recommended to limit the increases in intra-cranial pressure that may accompany intubation. The dose is 1.5 mg/kg.

Paralytics

Etomidate is a GABA agonist that does not increase intra-cranial pressure, nor does it have significant cardiovascular depressant effects. Because trauma patients are typically volume depleted and have a high risk of head injury, etomidate 0.3 mg/kg is commonly used as an induction agent in this setting. If neither of these conditions is suspected, thiopental in doses of 2-3 mg/kg is appropriate for induction. Rocuronium is a non-depolarizing neuromuscular blocking agent given in doses of 0.9 mg/kg. It is also reported to attenuate increases in intra-cranial pressure and is the preferred paralytic for use in patients with head injuries. Otherwise, 1.5 mg/kg of succinlycholine is appropriated for paralysis.

Placement

Maintaining cervical spine immobilization is essential. This is a three-person procedure with one person ensuring in-line immobilization, another performing Sellick's maneuver, and the third intubating the patient.

Post-procedure

Endotracheal tube placement should be confirmed using a variety of techniques. The most important of these is the operator's direct observation of the tube passing through the vocal cords. Other measures include observation of chest expansion, auscultation of the chest and abdomen, and detection of end-tidal carbon dioxide. A post-intubation chest X-ray (CXR) should be reviewed. The patient will also require ongoing sedation and paralysis with standard agents.

CASE TWO

History

A 32 year-old male was struck repeatedly about the chest and back with a hurly. He is awake, alert, and talking with a GCS=14. His vital signs are HR 105, BP 110/75, RR 30.

Primary Survey

The patient is awake and answers questions appropriately with a normal voice. He is complaining of right-sided chest pain and states, "I can't breathe".

Breathing

The patient becomes increasingly anxious, tachypneic, and tachycardic. His oxygen saturation drops to 85% on the monitor. His trachea becomes deviated and the breath sounds are decreased on the right side. The latest systolic blood pressure measurement is 85 mm Hg.

Tension Pneumothorax

Tension pneumothorax must be identified early in the primary survey. The physical exam findings include unilateral absence of breath sounds, tracheal deviation, and hypotension. The treatment is immediate needle decompression followed by tube thoracostomy.

CASE THREE

History

A 42 year-old female was unrestrained in an RTA and was ejected from her vehicle. She has a diminished level of consciousness. She is confused and moaning with a GCS of 11. Her vital signs are HR 120, BP 85/45, RR 25.

Primary Survey

The patient is brought to the ED unconscious. She is intubated because of a strong suspicion of head injury, low GCS, and hypotension. After intubation, breath sounds are clear, bilaterally, and symmetric.

Circulation

This patient is hypotensive in the setting of significant blunt trauma. There are a variety of etiologies for shock, but the most likely cause in the trauma patient is hypovolemia from acute blood loss. Tension pneumothorax and pericardial tamponade can also cause hypotension. The latter is more common after penetrating injuries to the chest. In the adult trauma patient, isolated intra-cranial bleeding patient does not cause significant hypotension. Accordingly, occult blood loss should be suspected in the head-injured patient with low blood pressure. Intra-abdominal hemorrhage is the most common source of occult blood loss in these patients. Hemothorax, bleeding as a result of long bone and pelvic fractures, and obvious external bleeding from lacerations can each be sufficient to produce hypotension.

FAST Ultrasound

The FAST scan stands for focused abdominal sonography in trauma. This technology is portable and can be rapidly obtained at the bedside of a critically-injured patient at the same time other members of the trauma team direct the resuscitative efforts and perform procedures. Numerous large studies have shown that non-radiologists, emergency physicians and surgeons, can interpret these scans with a high degree of sensitivity and thereby make important decisions regarding the next steps in the patient's care. A typical decision algorithm now in place at many U.S. trauma centers is as follows:

1. An unstable patient with a positive FAST scan will have an exploratory laparotomy
2. A stable patient with a positive FAST scan will have a CT scan of the abdomen and pelvis to better clarify the injury
3. An unstable patient with a negative FAST scan will undergo further testing to delineate the cause of shock, for example DPL, chest X-ray, etc.
4. A stable patient with a negative FAST scan can be observed

CASE FOUR

History

A young male is involved in an RTA. He veered off Strand Road into a brick wall in a single-car accident that minimally damaged his vehicle. The patient is unconscious with a GCS of three. His vital signs are HR 100 BP, 105/75, RR 10.

Primary Survey

The patient arrives to the ED unconscious. The team prepares to intubate. His breath sounds are clear and symmetric, but with minimal respiratory efforts. His peripheral pulses are full. The team finds no obvious external evidence of trauma and the patient's pupils are 3 mm bilaterally and sluggishly reactive.

Disability

In the ABCDE scheme of trauma care, "D" stands for disability. This underscores the importance of a careful neurological exam during the secondary survey. It also stands for dextrose and drugs, both of which complicate the management of the unresponsive trauma victim. Hypoglycemia and drug intoxications can result in altered mental status. Many times, these conditions are pre-existing and are, in fact, the cause of the accident. Patients with no obvious injuries but severely depressed mental status should receive naloxone as well as a bedside glucose determination before intubation.

CASE FIVE

History

An older man is found down on Bachelor's Quay alongside several empty pints of Guinness. The patient has a decreased level of consciousness with incomprehensible speech. His GCS is 12. with vital signs of HR 100 BP, 105/70, RR 20.

Primary Survey

The patient is presently protecting a patent airway. He has clear breath sounds bilaterally. His pulses are full and equal.

Exposure

The patient's clothing is removed and he is examined from head-to-toe. He is log rolled with full spinal protection. A 0.8 cm stab wound is noted on his left flank. A detailed secondary survey includes a complete physical examination. Especially in patients with diminished responsiveness and ethanol intoxication. Rigorous attention to detail may provide the only clue to a potentially serious injury. Hemotympanum may be the only finding to suggest basilar skull fracture. Inspection of the back, axillae, and perineum may reveal important penetrating injuries that are not otherwise apparent.

Penetrating Flank Injury

Historically, patients with this type of injury underwent mandatory surgical exploration. Now, a combination of serial physical examination, triple-contrast CT, and DPL, have minimized the number of operations performed. Triple-contrast CT (oral, intravenous, and rectal) has a sensitivity of 89-100%, and specificity of 98-100%. With

this more selective approach, few injuries are missed while a greater number of patients are spared exploratory laparotomy and its attendant complications.

CASE SIX

History

A 42 year-old male was unrestrained in a RTA. He ran a light and struck a coach of American tourists on Leeson Street. He is alert and talking with a GCS of 15. His vital signs are HR 110, BP 120/75, RR 20.

Primary Survey

The patient has a patent airway. His breath sounds are clear bilaterally. He has full peripheral pulses.

Secondary Survey

A detailed physical exam is completed. The only finding is an anterior chest wall contusion. CXR is obtained.

Traumatic Aortic Injury

The majority of patients with this injury die at the scene of the accident. This injury occurs when rapid deceleration forces are transmitted to the chest wall, as occurs in a high-speed RTA or a fall from a significant height. Patients who survive to the ED have a mortality rate that is directly related to the delay in diagnosis, making rapid diagnosis of this condition a potentially life-saving endeavor. Chest Xray findings suggestive of traumatic aortic injury are as follows:

1. First and second rib fractures
2. Obscuration of the aortic knob
3. Deviation of the trachea to the right
4. Pleural cap
5. Depression of the left main stem bronchus
6. Obliteration of the aorto-pulmonary window
7. Deviation of the naso-gastric tube to the right

Contrast Enhanced Spiral CT

New generation spiral CT scanners are now available. Many large studies have evaluated the use of these newer machines in the diagnosis of traumatic aortic injury and have repeatedly demonstrated a sensitivity of 99.8-100%. This corresponds to a negative predictive value of a negative scan of 100%. In other words, this devastating injury can be reliably ruled-out if the CT scan is negative.

REFERENCES

ATLS Manual 6th Edition 1997, Published by the American College of Surgeons, Chicago