



Chapter 5

EVALUATION OF THE ACUTELY INJURED PATIENT

KEY FIGURES:

Emergency cricothyrotomy
Emergency needle thoracostomy

This book primarily describes treatments for stable patients who have a specific injury or problem wound. They have been evaluated previously by a general surgeon, trauma surgeon, or emergency department physician, who has ruled out other, more life-threatening injuries.

Because health care providers cannot know what situation they may face, all of us must be aware of how to evaluate a patient with potentially serious injuries. This chapter provides basic principles for the important, life-saving initial evaluation and treatment of a patient who may have suffered a serious traumatic injury. It is not intended to be a full, detailed description of first-line treatments, but it does provide useful information for all health care providers.

Be sure to get as detailed a history as possible (from the patient, family, or whoever brought the patient to medical attention), but do *not* waste time. Your primary objective is to identify and treat potentially life-threatening injuries.

ABCs of Trauma Care

Following the ABCs (airway, breathing, circulation) and DE (disability and exposure) of trauma care prevents you from getting sidetracked by the patient's obvious injury (arm fracture, for example) and thereby missing a more life-threatening but less obvious injury.

Airway

An open airway (i.e., the path from the nose/mouth to the lungs) is vital for the patient to be able to breathe. You need to determine

quickly whether the airway is blocked. Blockage may be due to the tongue, vomit, blood, or foreign bodies.

Signs of Airway Obstruction

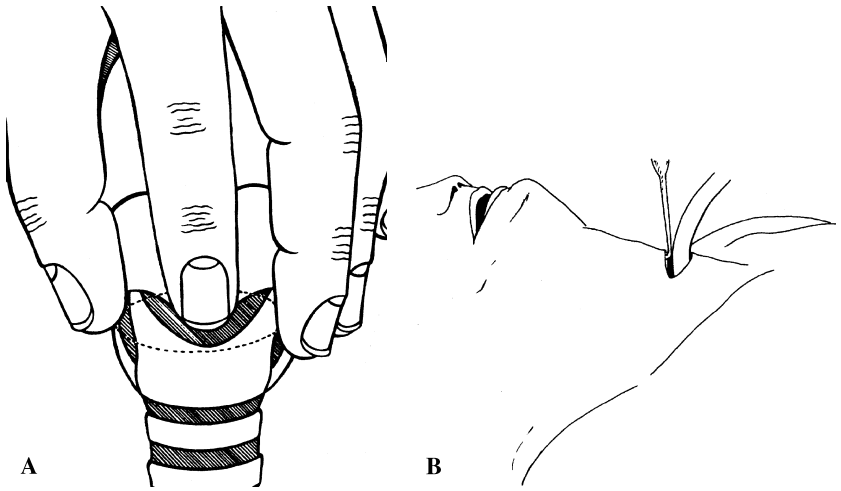
In **patients breathing on their own**, signs of airway obstruction include noisy breathing on inspiration and retractions of the supraclavicular space (area above the clavicle) or intercostal space (between the ribs) with attempts at respiration. In **nonbreathing patients**, it may be difficult to diagnose airway obstruction. You must look directly into the mouth and examine for signs of obstruction.

How to Maintain an Open Airway

- Clear out any blood or vomitus in the mouth.
- In an unconscious patient, the tongue may obstruct the airway because of loss of tone in the muscles of the lower jaw (mandible).
- Proper patient positioning often relieves obstruction due to a posteriorly displaced tongue.
- To position the tongue forward, gently lift the chin to bring the mandible forward. Be careful not to extend the cervical spine (because of concerns about possible undiagnosed cervical spine injury).
- An artificial oral or nasal airway tube can be useful, but in a conscious patient it may cause gagging and agitation. Use with caution—such devices are not comfortable.
- Intubation with an endotracheal tube is often the best way to maintain an open airway.
- When intubation is impossible, a surgical airway (cricothyroidotomy or tracheotomy) is required.

Surgical Cricothyroidotomy. A cricothyroidotomy is done only in emergency situations when no other means is available to maintain an open airway. The following guidelines are helpful:

1. The cricothyroid membrane can be located by running your finger down the center of the neck and feeling the wide thyroid cartilage (Adam's apple). The depression just below the Adam's apple is where you want to place the incision. The rings of the trachea are palpable just below this area.
2. Try to clean the area with Betadine.
3. If you have time, inject the skin with lidocaine and epinephrine to decrease bleeding from the skin edges and to make the procedure a little easier to perform.



Emergency cricothyroidotomy. *A*, The larynx is stabilized between the left thumb and middle finger. The tip of the index finger is inserted over the cricothyroid membrane. Keep the index finger in this position to identify the position of the cricothyroid membrane as you perform the procedure. *B*, The endotracheal tube in position. (From Simon RR, Brenner BE (eds): *Emergency Procedures and Techniques*, 3rd ed. Baltimore, Williams & Wilkins, 1994, with permission.)

4. The neck should be in neutral position with the chin held slightly forward.
5. Hold the thyroid cartilage between your thumb and middle finger (actually you are stabilizing the larynx). Use your index finger to help identify the cricothyroid membrane.
6. Using a no. 15 knife blade, make a horizontal incision no more than 2 cm long, just below the Adam's apple. Be sure to stay in the center of the neck. Do *not* make this incision too large, or you may injure a nearby vein, thereby causing significant bleeding and making the procedure very difficult.
7. Staying in the midline, gently push the knife so that it goes through the cricothyroid membrane. Do not push inward too far; use only the knife tip. You do not want to injure the esophagus, which is immediately behind the trachea.
8. Insert the back of the knife handle (not the blade) through the opening that you have just made, and rotate the handle to enlarge the opening.
9. Place the largest possible pediatric endotracheal tube through the opening. Give oxygen and ventilate the patient through this tube.
10. Secure the tube in place with tape or sutures.

Breathing

Breathing relates to getting oxygen to the tissues. All patients with any possibility of having sustained a head injury or with an altered level of consciousness should be given supplemental oxygen, which usually can be administered with a face mask or nasal prongs.

Listen for bilateral breath sounds, demonstrating that both lungs are inflated (see “tension pneumothorax” below). Problems that interfere with oxygen getting to the tissues are often related to significant chest trauma.

Circulation

Circulation pertains to the patient’s blood pressure and secure intravenous access. Start an intravenous line with the largest available catheter, and hang a liter of 0.9% saline.

The most common reason for hypotension (low blood pressure) in a trauma patient is blood loss, either external or internal. Control obvious hemorrhage. Be careful of scalp wounds—a lot of blood can be lost from the scalp. A closed fracture of the femur can result in the loss of a liter of blood into the tissues of the thigh, which may not be immediately obvious.

A head injury in and of itself does *not* cause hypotension. Look for another source. In contrast, a spinal cord injury can result in profound hypotension without blood loss (see “Neurogenic shock” below) because of loss of vascular tone.

How to Determine Blood Pressure Without a Working Blood Pressure Cuff

Feel for palpable pulses at the wrist (radial artery), groin (femoral artery), and neck (carotid artery).

Location of Palpable Pulse	Minimal Approximate Systolic Blood Pressure (mmHg)
Radial artery	80
Femoral artery but not radial artery	70
Carotid artery but not femoral and radial arteries	60

Other Causes of Hypotension/Shock that Can Lead to Death if not Quickly Diagnosed

Tension pneumothorax occurs when the lung has collapsed and air surrounds the lung. If the air is not removed and the lung reexpanded, build-up of pressure in the chest may cause the lung, great vessels, and even

heart to be compressed and pushed to the opposite side. This process impairs blood flow to and from the heart and leads to hypotension.

Cardiac tamponade is a build-up of fluid in the sac around the heart. It can lead to cardiac dysfunction and shock.

Neurogenic shock occurs with an injury that causes paralysis—i.e., a spinal cord injury, *not* a head injury. Because of the loss of nerve input, the blood vessels dilate. Even with minimal blood loss, the patient cannot maintain proper vascular tone, and hypotension develops.

Acute myocardial infarction (heart attack) or any cause of cardiac dysfunction can result in hypotension.

Disability

The following brief exam helps to evaluate patients for the presence of a neurologic deficit:

1. Check the pupils. Are they equal, round, and reactive to light?
2. Is the patient conscious?
3. Can the patient move the fingers and toes?
4. For patients with a suspected head injury, the Glasgow Coma Score (GCS) should be determined. Fifteen, the highest (best) score, indicates that the patient is awake and alert; three, the lowest (worst) score, indicates that the patient is unconscious and unresponsive.

Glasgow Coma Score

Category	Best Response	Points Assigned
Eye opening	None	1
	Opens eyes to painful stimulus	2
	Opens eyes to voice	3
	Opens eyes spontaneously	4
Verbal response	None	1
	Unintelligible sounds	2
	Inappropriate words	3
	Disoriented but converses	4
	Fully oriented and converses appropriately	5
Motor response	None	1
	Decerebrate posturing (abnormal extension)	2
	Decorticate posturing (abnormal flexion)	3
	Moves randomly to painful stimulation	4
	Localizes pain	5
	Obeys commands	6

Add up the points. An uninjured patient who is not intoxicated should score 15 points. A score of 13 points may indicate minor injury; scores of 9–12, moderate injury; and scores < 8, severe injury.

Caution: Do not assume that a low GCS is due to intoxication. A drunk person can definitely have a serious head injury. Do a thorough work-up (usually a computed tomography [CT] scan is required).

Exposure

All clothing should be removed so that the patient is fully exposed. Removal of clothing allows you to examine the patient thoroughly for signs of injury. It may seem silly, but you do not want to be fooled.

Patients usually are lying on their back during the evaluation. To examine the back for evidence of spine injury, log-roll the patient (i.e., roll the patient in one motion, keeping the back straight and preventing any twisting motion of the spine).

Case Study

An 18-year-old man is brought into the hospital after being stabbed in the right upper arm with an icepick. He complains of pain in the arm but otherwise seems to be uninjured. You roll up his sleeve to examine the arm and see entrance and exit sites. Since he has good pulses in the extremities, you think that he is stable. While you are doing some paperwork, he becomes very short of breath and hypotensive. What happened?

If you had removed his shirt, you would have seen that the puncture went through the arm and into the right chest. A pneumothorax developed. Because he was young and healthy, he was able to tolerate it until the pressure built up in the chest cavity. At that point he developed a tension pneumothorax—a true emergency!

Only when the patient is stable from the perspective of the ABCs can you undertake specific evaluation of more obvious injuries.

Needle Thoracostomy

Needle thoracostomy is a life-saving procedure that is easy to do in patients with **tension pneumothorax**. All health care providers should be aware of this technique.

If conscious, the patient with tension pneumothorax is severely short of breath and blood pressure is low. If unconscious, the patient may simply be hypotensive and not breathing well.

If you listen over the chest for breath sounds, you may appreciate a loss of breath sounds on the side of the pneumothorax, but this may be difficult to appreciate in the emergency setting.

Another method is to feel the patient's neck. The trachea shifts **away** from the side with the tension pneumothorax.

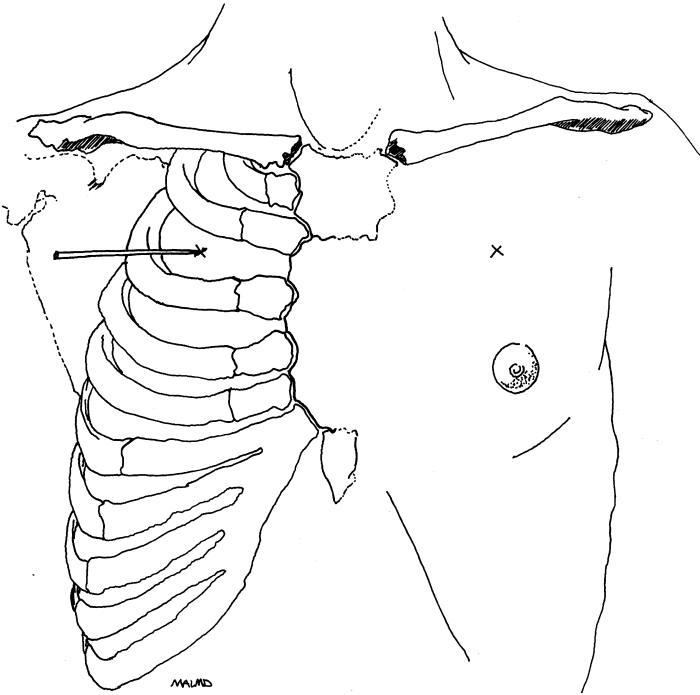
If you cannot hear breath sounds in either side of the chest, the trachea is in the midline, and the patient is in shock, treat both sides of the chest. The patient may have bilateral tension pneumothoraces.

Equipment Needed

1. Large catheter for intravenous access (12 or 14 gauge). A large-bore needle can be used if a catheter is not available, but the catheter is safer. The needle can injure an underlying structure more easily.
2. Betadine, if available.

Procedure

1. Apply Betadine to the chest. Simply pour it on—this is an emergency!
2. Place the catheter, with the needle in place, into the affected side of the chest at the second interspace in the midclavicular line (the imaginary line drawn perpendicular to the clavicle at its midpoint).
3. Locate the second interspace.
 - The second interspace is the space between ribs 2 and 3.
 - It can be located by feeling for the spot on the breastbone (sternum) where the manubrium and sternum meet (the point where you can feel an elevation in the bone as you rub your fingers up and down the breastbone).
 - Move your fingers to the right or left chest (depending on where the problem is). You should be at the second interspace when you are at the midclavicular line.
4. The intercostal vessels run just below each rib. To prevent injury to these vessels, the catheter should be inserted into the chest at the second interspace just above the third rib.
5. If you inserted a catheter, remove the needle, but leave the catheter in place. You will hear a big whoosh from the escaping air.
6. Leave the catheter in place until help arrives.
7. If you used a needle, you should hear the air escape as soon as you enter the pleural space. Leave the needle in place until help arrives.
8. The patient requires a chest tube for definitive treatment of the pneumothorax, but you may have just saved the patient's life.



Emergency needle thoracostomy. At the midclavicular line, insert a large (14-gauge) needle or vascular catheter into the chest at the second interspace just above the third rib. You will hear a large rush of air when the needle enters the chest.

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