

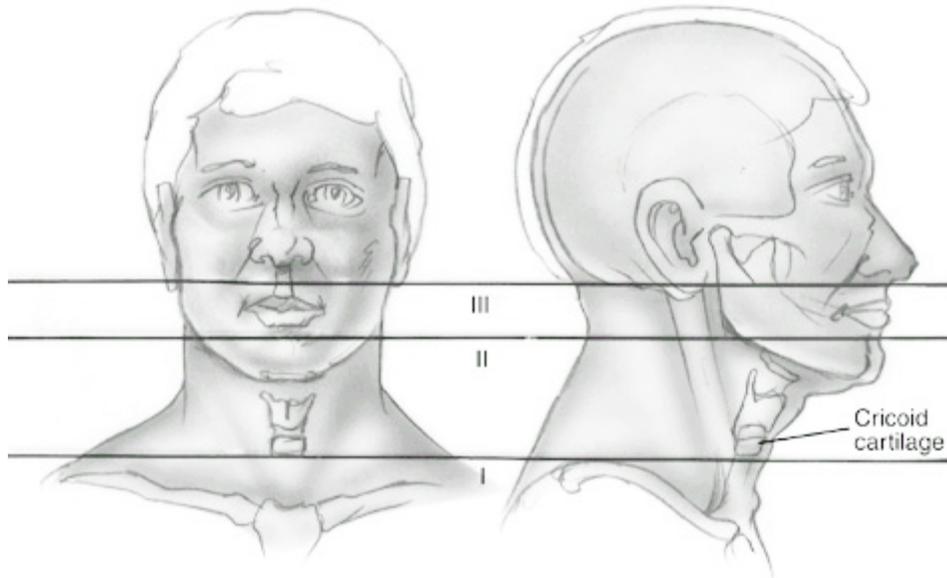
**McHenry Western Lake County EMS System
Paramedic, EMT-B and PHRN
Optional Continuing Education
2019 #3
Penetrating Neck Trauma**

Penetrating neck injury (PNI) comprises 5 to 10 percent of traumatic injuries in adults and is caused primarily by bullets, knives and other impaling objects (e.g., shrapnel, glass). Wounds caused by low velocity guns or impaling objects tend to cause fewer aerodigestive (the combined organs and tissues of the respiratory tract and the upper part of the digestive tract) and vascular injuries. High velocity injuries carry a greater likelihood of serious injury and death. Overall mortality ranges from 3 to 10 percent.

PNI is categorized by anatomic zones (which are described below). Mortality in patients with PNI is highest with zone I injuries because of the nature of the vascular injuries. Exsanguination is the most common cause, and the carotid artery is the structure most often involved. The incidence of carotid artery injury in PNI ranges from 6 to 17 percent.

Zones of Injury

Neck anatomy is complex with aerodigestive and neurovascular structures confined to a small area. PNI is described according to the zone of injury.



Zone I

Extends from the clavicle to the cricoid cartilage and includes the thoracic inlet. This region contains the major vascular structures of the subclavian artery and vein, jugular vein, and common carotid artery, as well as the esophagus, thyroid, and trachea.



Zone II

Extends from the cricoid to the angle of the mandible and contains the common carotid artery, internal and external carotid arteries, jugular vein, larynx, hypopharynx, and cranial nerves X, XI, and XII.



Zone III

Is a small but critical area extending from the angle of the mandible to the skull base. This region contains the internal and external carotid arteries, jugular vein, lateral pharynx, and cranial nerves VII, IX, X, XI, and XII.



Penetrating injuries can cross zone boundaries depending upon the implement or projectile and its angle of penetration. Therefore, you must consider the possibility of injuries within zones other than that containing the entrance wound. For example PNI sustained from a downward stab wound that enters the anterior neck in zone II may also injure the lungs and mediastinal structures.



This severe laceration to the neck spans all three neck injury zones and extends into the mediastinum.

Vascular injuries arising from penetrating trauma may occur directly, causing a partial or complete transection of the vessel or inducing formation of an intimal flap, arteriovenous fistula, or pseudoaneurysm. Injury to the blood vessels can also result from external compression or mural contusion. Thrombosis is the most common complication of blood vessel injury, occurring in 25-40% of patients.

Specific Injuries

Laryngotracheal Injuries: Laryngotracheal injuries are predominantly confined to the cervical trachea. Such injuries can result in respiratory distress, stridor, subcutaneous air, hemoptysis, impairment in producing voice sounds or swallowing, or anterior neck tenderness.



Clinical photograph showing subcutaneous emphysema

Vascular Injuries: These can involve the carotid artery, the subclavian and vertebral arteries, and the vertebral, brachiocephalic and jugular veins. Vascular wounds are not always obvious. Besides the obvious signs (severe bleeding, decreased or absent peripheral pulses, global or focal neurologic deficits, expanding hematoma and bruits), look for more subtle signs including mild bleeding, transient hypotension that responds to fluid resuscitation and nonexpansile hematomas. Intact pulses do not negate the possibility of vascular injury. Global neurologic deficits (e.g. hemiplegia) can be caused by a vascular injury. A patient with a normal physical examination who is otherwise asymptomatic is unlikely to have sustained a severe vascular lesion.



Pharyngoesophageal Injuries: These injuries are uncommon but carry a high mortality. They can be difficult to detect clinically and appear to be the leading cause of delayed death from neck trauma. Since there are no signs and symptoms that are specific to the diagnosis of esophageal injury, you should have a high level of suspicion in patients presenting with dysphagia, blood in the saliva, hematemesis and subcutaneous air.

Nervous System Injuries: Penetrating neck injury can involve the central nervous system (or the peripheral nervous system). High spinal cord injury can result in spinal shock with hypotension and bradycardia. Partial cord lesions create variable combinations of motor and sensory deficits depending on the lesion. Peripheral and Cranial nerve injuries may not be obvious unless a careful neuro exam is performed. Assess speech (CN IX, X, XII), movement of the palate and gag reflex (CN IX, X), tongue (CN XII), and shoulder shrug (CN XI).



CT scan film showing tip of the knife reaching up to spinal column injuring the spinal cord.

Pre-hospital Management

Any patient with a penetrating neck injury (PNI) can decompensate rapidly and should be transported immediately to the nearest trauma center. These patients often require emergency surgical intervention. Impaled objects should not be removed in the field.

Airway management in the patient with PNI can be difficult. Orotracheal intubation is the primary approach to airway management when a definitive airway is required immediately. Bag mask ventilations (BMV) can be used during transport. BVM can become problematic, however, if an airway injury is present. BMV can force air into the soft tissue planes leading to anatomical distortion. The presence of subcutaneous emphysema in the neck is a relative contraindication to BMV.

During transport, auscultate breath sounds and assess vital signs frequently. Hypotension, tachypnea, unilaterally diminished breath sounds, and subcutaneous emphysema raise suspicion for a tension pneumothorax. Paramedics should contact medical control for permission to perform needle decompression when the patient is unstable and tension pneumothorax is suspected.

Place a large bore IV in the arm opposite the injury if possible and control active bleeding with direct pressure. Patients with bubbling or sucking neck wounds should ideally be placed head-down (Trendelenburg position) with their left side down to avoid potential vascular air embolism. Gauze impregnated with petroleum jelly should be applied to the wound to prevent venous air embolus.

Cervical spine immobilization should be applied if history, MOI or clinical findings suggest C-spine injury. Patients in need of C-spine immobilization who have difficulty breathing from hemorrhage may need their backboard turned to its side, or may need to sit upright while maintaining C-spine precautions as best as possible.

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POST TEST

Name: _____

Department : _____

Date: _____

Match the zone with its boundaries and anatomical structures contained in them.

1. ____ Zone I	A. Is a small but critical area extending from the angle of the mandible to the skull base. This region contains the internal and external carotid arteries, jugular vein, lateral pharynx, and cranial nerves VII, IX, X, XI, and XII.
2. ____ Zone II	B. Extends from the cricoid to the angle of the mandible and contains the common carotid artery, internal and external carotid arteries, jugular vein, larynx, hypopharynx, and cranial nerves X, XI, and XII.
3. ____ Zone III	C. Extends from the clavicle to the cricoid cartilage and includes the thoracic inlet. This region contains the major vascular structures of the subclavian artery and vein, jugular vein, and common carotid artery, as well as the esophagus, thyroid, and trachea.

4. Penetrating injuries can cross zone boundaries depending upon the implement or projectile and its angle of penetration.
 - A. True
 - B. False
5. Laryngotracheal injuries can result in:
 - A. Stridor
 - B. Subcutaneous air
 - C. Impairment in producing voice sounds
 - D. All of the above
6. Vascular wounds in penetrating neck trauma are always obvious
 - A. True
 - B. False
7. A patient with a normal physical examination who is otherwise asymptomatic is unlikely to have sustained a severe vascular lesion.
 - A. True
 - B. False

8. Pharyngoesophageal injuries are uncommon but carry a high mortality.
 - A. True
 - B. False
9. Patients presenting with _____, _____, _____, and _____ should make you have a high level of suspicion for an esophageal injury.
10. High spinal cord injury can result in _____ and _____.
11. Partial cord lesions create variable combinations of motor and sensory deficits.
 - A. True
 - B. False
12. Impaled objects should be removed in the field.
 - A. True
 - B. False
13. Subcutaneous emphysema is a relative contraindication to BMV.
 - A. True
 - B. False
14. Patients with a sucking neck wound should be placed _____ with their _____ side down to avoid potential vascular air embolism.
15. You're called to a report of a man assaulted. On arrival, you find a 42-year-old male with a severe open neck wound. The patient was apparently attacked, and a bystander found him walking down the road with uncontrolled bleeding from a stab wound to the neck. The patient is unconscious with agonal breathing. You feel no pulse. CPR is started, monitor shows PEA (sinus rate of 136). Discuss your plan of care for this patient.

IF YOU ARE NOT A MEMBER OF THE MCHENRY WESTERN LAKE COUNTY EMS SYSTEM, PLEASE INCLUDE YOUR ADDRESS ON EACH OPTIONAL QUIZ TURNED INTO OUR OFFICE. OUR ADDRESS IS: NORTHWESTERN MEDICINE - MCHENRY HOSPITAL EMS, 4201 MEDICAL CENTER DRIVE, MCHENRY, IL 60050. WE WILL FORWARD TO YOUR HOME ADDRESS VERIFICATION OF YOUR CONTINUING EDUCATION HOURS.

IF YOU ARE A MEMBER OF OUR EMS SYSTEM, YOUR CREDIT WILL BE ADDED TO YOUR IMAGE TREND RECORD. PLEASE REFER TO IMAGE TREND TO SEE YOUR LIST OF CONTINUING EDUCATION CREDITS. ANY QUESTIONS REGARDING THIS CAN BE ADDRESSED TO CINDY TABERT AT 224-654-0160. PLEASE FAX YOUR QUIZ TO CINDY TABERT AT 224-654-0165.