



# Penetrating wounds: Gunshot wounds, neck injuries, & forensic concerns

By: Michelle Littleton



Etiology/  
pathophysiology

---

On-scene treatment

---

ED treatment

---

Role of the ED nurse

---

Discharge/prevention  
instructions

# Etiology/ Pathophysiology

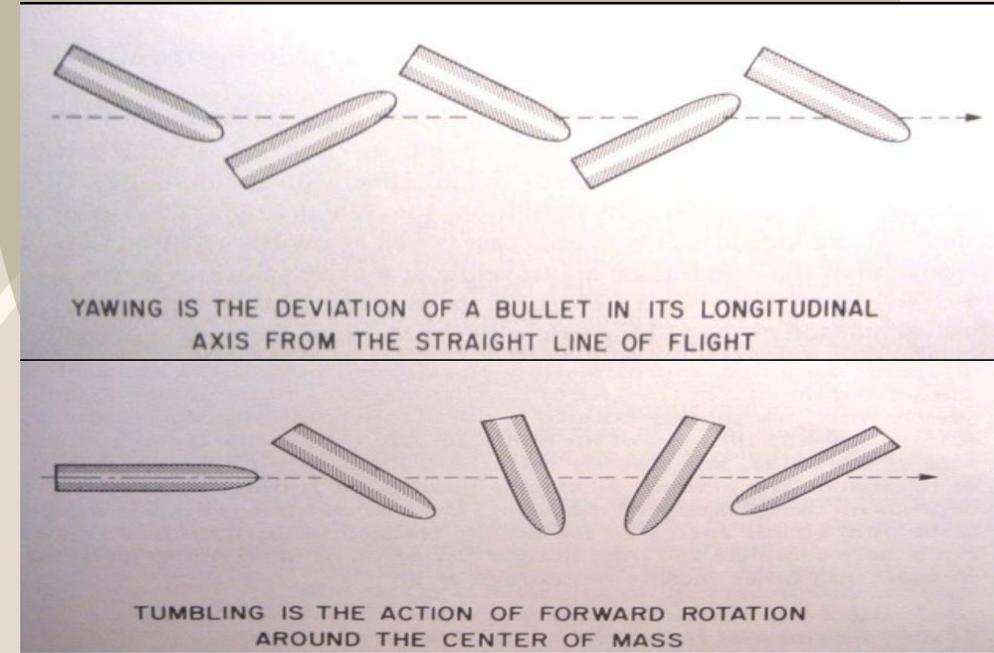
- ❖ Gunshot wounds
  - ❖ Low Velocity – direct tissue destruction
    - ❖ Bullet travels less than 1200 ft/second
    - ❖ Cavitation wound size will be 3-6 times bigger than original bullet diameter
  - ❖ High Velocity – lateral tissue is involved and damaged
    - ❖ Bullet travels greater than 3000 ft/second
    - ❖ Cavitation wound size will be 30-40 times bigger than original bullet size



# Etiology/Pathophysiology

## Gunshot terminology to know

- ❖ Yaw – Rotation of the nose of the bullet from a straight path/the line of flight
- ❖ Tumbling – End on end rotations of the bullet in motion
- ❖ Cavitation – Cavity (expansion of the surrounding tissue) left from high velocity entry of a bullet



# Pathophysiology

## Neck Injuries

- ❖ Neck anatomy – categorized by 3 zones or 2 triangles

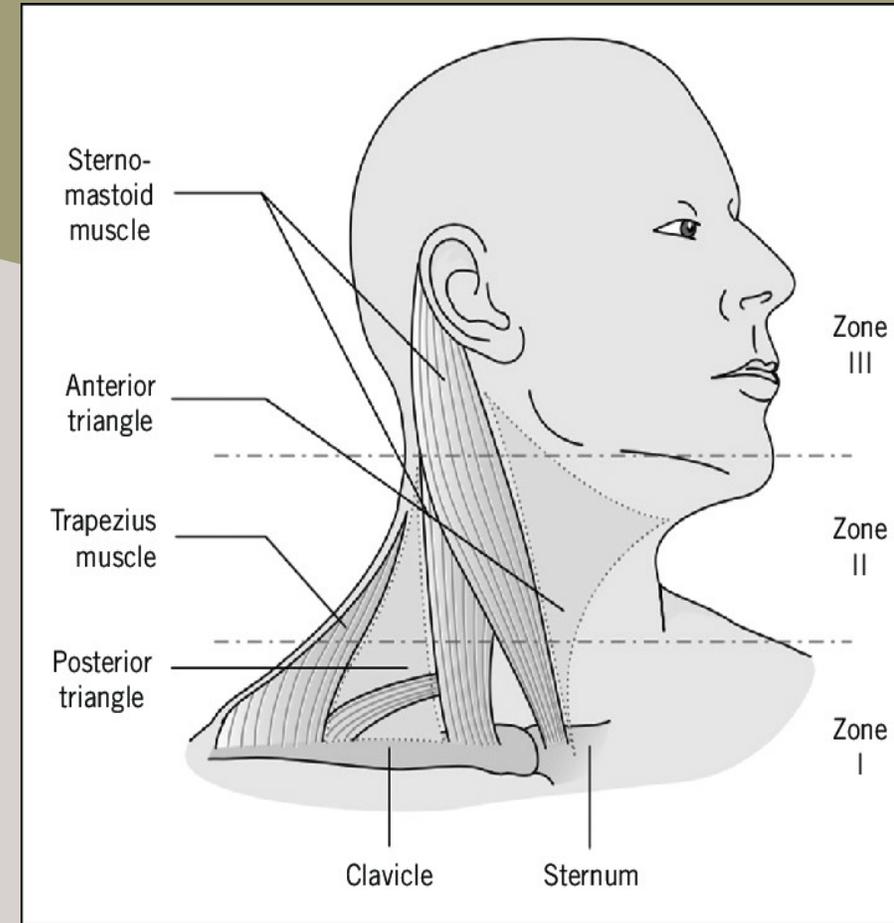
- ❖ Zone 1 – located between clavicles and the cricoid cartilage

- ❖ Zone 2 – located between cricoid cartilage and angle of mandible

- ❖ Zone 3 – located between angle of mandible and the base of the skull

- ❖ Anterior triangle – Larynx, trachea, pharynx, esophagus, & major vascular structures

- ❖ Posterior triangle – muscles, spinal accessory nerve, & spinal column



# Pathophysiology

## Types of neck trauma

- ❖ Blunt trauma - closed trauma
  - ❖ Motor vehicle accidents
  - ❖ Sports injuries
- ❖ Penetrating trauma
  - ❖ Stab wounds
  - ❖ Gunshot wounds
  - ❖ Vascular injury
- ❖ Near hanging/strangulation
  - ❖ External neck pressure causes cerebral hypoxia due to venous and arterial obstruction

# On-scene Treatment

- ❖ Gunshot wounds
  - ❖ Safety first!!! – survey the area
  - ❖ What type of gun used to help determine bullet type and possibility of fragments, and multiple wounds
  - ❖ Stabilization
    - ❖ Control/stop any bleeding
    - ❖ Control contamination

# On-scene Treatment

- ❖ Neck Injuries
  - ❖ Stabilization
    - ❖ Keep patient still
    - ❖ Avoid moving head or neck
    - ❖ Apply cervical collar
- ❖ Impaled objects
  - ❖ Control/stop any bleeding
  - ❖ Stabilization
    - ❖ Do not remove object in field or in transport
    - ❖ Object may be compressing injured vessels and stopping the vessel from bleeding
  - ❖ Length of object
    - ❖ May need to be carefully cut down prior to transport - be cautious not to cause secondary injury

# On-scene Treatment

- ❖ Forensic Concerns
  - ❖ Preservation of evidence
  - ❖ Put hands in paper bags
  - ❖ When cutting off clothing do not cut through any bullet holes, stabbing holes, or blood-stained areas, cut around these areas
  - ❖ Label everything removed
  - ❖ Control contamination
  - ❖ Obtain weapon that caused injury, be sure to wear gloves to protect potential evidence
  - ❖ Keep chain of custody to a minimal amount of personnel

# On-scene Treatment

## ❖ Goal

- ❖ Immediate identification of life-threatening injuries
- ❖ Airway maintenance
- ❖ Transport to appropriate medical facility either by ground or air
- ❖ Recognition and control of external bleeding and shock
- ❖ Immobilization of patient
- ❖ Initiation of peripheral IV
- ❖ Pain management
- ❖ Relay information to ED prior to arrival for proper planning

# On-scene Treatment

SURVEY THE SCENE  
LOOK FOR HAZARDS  
SAFETY FIRST

SCENE OBSERVATION  
MECHANISM OF INJURY  
BLOOD SPLATTER  
BLOOD SOAKED  
CLOTHING

PRIMARY ASSESSMENT  
LIFE THREATENING INJURIES  
CONTROL EXTERNAL BLEEDING  
LOC  
ABC'S

STABILIZATION  
INITIATE CPR IF PATIENTS  
HAS NO PULSE  
SECURE AIRWAY  
SECURE ANY IMPALED  
OBJECTS

SECONDARY ASSESSMENT  
FULL HEAD TO TOE  
BASELINE VITALS  
HISTORY  
EVENTS

TRANSPORTATION  
PREPARE FOR IMMEDIATE  
TRANSPORTATION TO  
APPROPRIATE FACILITY  
EITHER BY GROUND OR  
AIR

# ED treatment

- ❖ Advanced trauma life support (ATLS) guidelines
  - ❖ Guiding principles delineate a systemic approach to initial assessment
  - ❖ Rapid assessment
  - ❖ Immediate identification of life-threatening injuries
  - ❖ Initial resuscitation of trauma patients
- ❖ Primary Assessment
  - ❖ Airway
  - ❖ Breathing
  - ❖ Circulation
  - ❖ Other assessments



# ED treatment

## ❖ AIRWAY

- ❖ Major or significant bleeding
- ❖ Airway displacement/obstruction
- ❖ Adequate protection of airway
- ❖ Inadequate protection of airway
- ❖ Insufficient airway
- ❖ Significant bleeding into airway

## ❖ BREATHING

- ❖ Penetrating trauma
- ❖ Chest wound
- ❖ Significant bleeding



# ED treatment



- ❖ CIRCULATION
  - ❖ Tachycardia
  - ❖ Hypotension
  - ❖ Decreased cap refill
  - ❖ Cool or mottled extremities
- ❖ OTHER ASSESSMENTS
  - ❖ Assess for signs/symptoms of shock
  - ❖ Diagnostics
  - ❖ Localized external hemorrhage and shock
  - ❖ Long bone fractures
  - ❖ Other internal injuries

# ED treatment

## ❖ STABILIZATION

- ❖ Stabilize patient and any impaled objects until patient can get to the OR

- ❖ Stabilize spine and neck until spinal cord injuries ruled out and airway/breathing is secured

## ❖ COMPLICATIONS

- ❖ Airway obstruction
- ❖ Aspiration
- ❖ Vocal cord paralysis
- ❖ Perforated esophagus
- ❖ Severe vascular injury
- ❖ Necrotizing infection
- ❖ Stroke
- ❖ Air embolism
- ❖ Pneumothorax
- ❖ Hemothorax



## HOW TO STABILIZE AN IMPALEMENT WOUND

© Art of Manliness and Ted Slampyak. All Rights Reserved.

# ED Treatment

## Special consideration: Infection

### INTERNAL CONCERNS

- o Any object, whether bullet, knife, impaled object has the potential to nick or penetrate vitals organs and the bowel
- o Treatment can include systemic antibiotics and surgical intervention to repair bowel
- o Temporary cavity created by a bullet can create negative pressure and suck in dirt, clothing particles, and any foreign matter and microorganisms

# ED Treatment

## Special consideration: Infection

### EXTERNAL CONCERNS

- o Bullets , knives, and any foreign object that enters the body carries debris from clothing, gun (bullets), and environment

### PREVENT CONTAMINATION AND INTRODUCTION OF INFECTION

#### o Gloves

- Prevent spread of microorganisms and blood borne pathogens
- Needed to preserve evidence
  - Don gloves prior to handling any evidence

### FOLLOW-UP WOUND CARE

- o Correct cleaning of wound by patient and nurse

# Trauma Team

TRAUMA SURGEON

EMERGENCY  
PHYSICIAN

ANESTHESIOLOGIST

SURGICAL  
RESIDENT

NEUROLOGIST

RESPIRATORY

RADIOLOGY  
TECHNICIAN

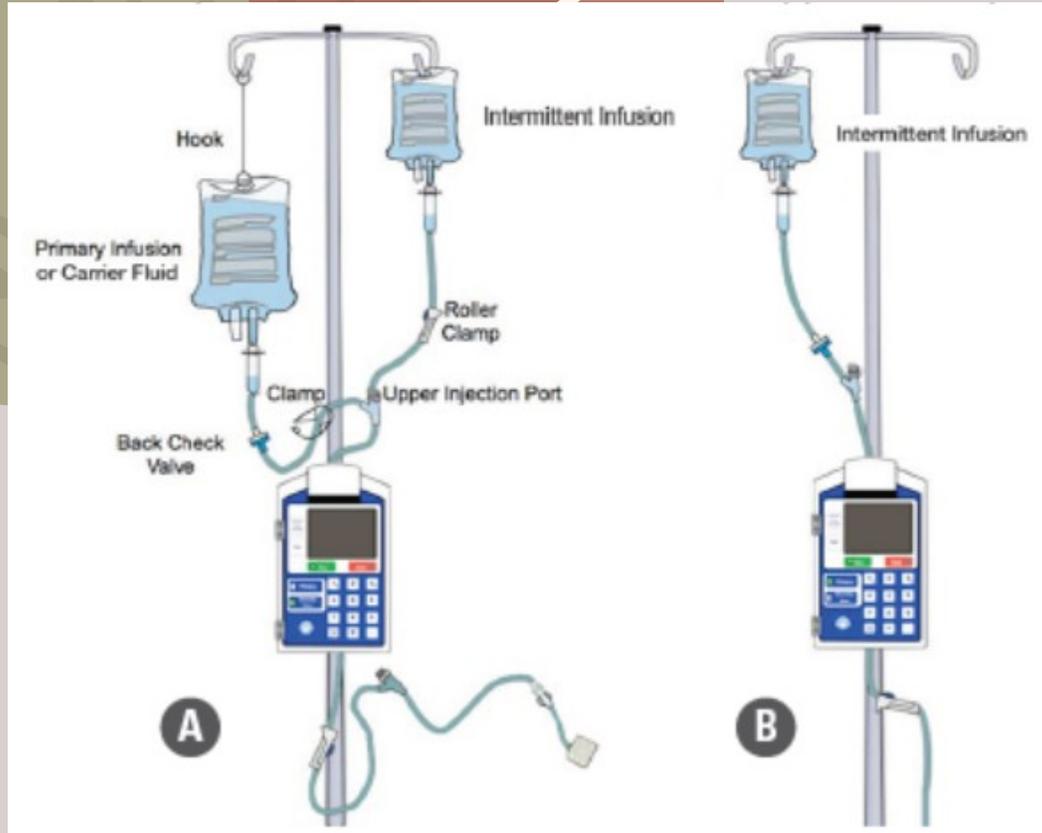
AT LEAST 2  
EMERGENCY RN'S

ADDITIONAL NURSES AND  
STAFF AS NEEDED

# ROLE OF THE ED NURSE

- ❖ Quick and thorough assessment
- ❖ Airway – always a priority
- ❖ Maintain cervical spine immobilization
- ❖ Breathing
- ❖ Circulation
  - ❖ Control bleeding-direct and simple pressure
  - ❖ Air sucking wounds covered with Vaseline gauze
- ❖ Disability
- ❖ Exposure
  - ❖ Removal of clothing – be cautious of evidence, bullet holes, stab wounds, blood splatter

# ROLE OF THE ED NURSE



- ❖ Resuscitation
  - ❖ IV
  - ❖ IVF
  - ❖ Blood
- ❖ History and physical
  - ❖ Mechanism of injury
  - ❖ Allergies
  - ❖ Medications
  - ❖ Past medical
  - ❖ Last meal
  - ❖ Events/environment related to injury
- ❖ Administer medications

# ROLE OF THE ED NURSE

- ❖ Constant open communication with entire team and any multidisciplinary members as needed
- ❖ Documentation of wounds
- ❖ Preservation/documentation of evidence

# Discharge and Prevention Teaching

## INFECTION PREVENTION

- o Proper wound care
  - Hand hygiene
  - Keep clean and dry
    - Showering ok
    - Do not submerge
  - Cleansing
    - Wash hands
    - Gently use swab
  - Dressing changes
    - Hand hygiene
    - If bleeding occurs, apply clean gauze & hold pressure

# Discharge and Prevention Teaching

## WHEN TO NOTIFY PROVIDER

- o Fever greater than 100.4 F
- o Wound not healing, continuously reopens
- o Yellow/green discharge, foul odor, or bleeding
- o Redness and swelling around wound

# Discharge and Prevention Teaching

## RESOURCES

- o Home health nurse if warranted
- o Physical/Occupational therapy
- o Dietician
- o Social Worker
- o Spiritual guidance
- o Psychological counseling/mental health support

# Discharge and Prevention Teaching

## MEDICATIONS



- o Provide detailed instructions to patient or designated caregiver
- o Provide written resources on medications, proper use, action, proper administration
- o Advise to complete all antibiotics as prescribed
- o Notify provider of any adverse reactions

# Summary

- ❖ Gunshot wounds
  - ❖ Low velocity
  - ❖ High velocity
  - ❖ Yaw
  - ❖ Tumble
  - ❖ Cavitation
- ❖ Neck trauma/anatomy
  - ❖ Zone 1, 2, 3
- ❖ Stabilization
  - ❖ Gunshot wounds
  - ❖ Stabbings
  - ❖ Impalements
- ❖ Forensic concerns
  - ❖ Preservation of evidence
  - ❖ Evidence collection
  - ❖ Chain of custody
- ❖ Infection
  - ❖ Debris
  - ❖ Penetration of the bowel
- ❖ Airway issues
  - ❖ Airway always top priority

QUESTIONS?

The background features a light gray base with several organic, flowing shapes. On the left, there is a large, solid reddish-brown shape. On the right, there is a large, solid olive-green shape. A thin, white outline of a leafy branch is visible in the upper left corner, overlapping the gray background.

Thank you

Michelle Littleton

# S

Ahn, S. R., Lee, J. H., Kim, K. Y., & Park, C. Y. (2021, December 16). Pre-hospital and in-hospital management of an abdominal impalement injury caused by a tree branch. *Journal of Trauma and Injury*. Retrieved March 19, 2023, from <https://doi.org/10.20408/jti.2021.0051>

Alao T, Waseem M. (2022 Aug 7). Neck Trauma. In *StatPearls*. StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK470422/>

Baum, G. R., Baum, J. T., Hayward, D., & MacKay, B. J. (2022). Gunshot Wounds: Ballistics, Pathology, and Treatment Recommendations, with a Focus on Retained Bullets. *Orthopedic research and reviews*, 14, 293–317. <https://doi.org/10.2147/ORR.S378278>

*Forensic evidence collection, OR*. (2022). Lippincott procedures. <https://procedures.lww.com>

Lotfollahzadeh, S., & Burns, B. (2022, December 3). Penetrating abdominal trauma In *StatPearls*. StatPearls Publishing. <https://pubmed.ncbi.nlm.nih.gov/29083811/>

Nowicki, J. L., Stew, B., & Ooi, E. (2018). Penetrating neck injuries: A guide to evaluation and management. *Annals of the Royal College of Surgeons of England*, 100(1), 6–11. <https://doi.org/10.1308/rcsbull.2018.6>

Seok, J., & Cho, H. M. (2018). Clinical analysis of the patients with isolated low-velocity penetrating neck injury. *Journal of Trauma and Injury*, 31(1), 1–5. <https://doi.org/10.20408/jti.2018.31.1.1>

Silva, R. X., Ferreira, C. A. A., Sá, G. G. M., Souto, R. Q., Barros, L. M., & Galindo-Neto, N. M. (2022). Preservation of forensic traces by Nursing in emergency services: a scoping review. Preservação de vestígios forenses pela enfermagem nos serviços de emergência: revisão de escopo. *Revista latino-americana de enfermagem*, 30, e3593. <https://doi.org/10.1590/1518-8345.5849.3593>

Urden, L. D., Stacy, K. M., & Lough, M. E. (2020). 24. In *Priorities in critical care nursing* (Linda D. Urden, Kathleen M. Stacy, Mary E. Lough). (pp. 429–456). Mosby.

van Maarseveen, O. E. C., Huijsmans, R. L. N., Leenen, L. P. H., & Ham, W. H. W. (2022). Variation of in-hospital trauma team staffing: new resuscitation, new team. *BMC emergency medicine*, 22(1), 161. <https://doi.org/10.1186/s12873-022-00715-4>

# Images taken from the following websites

- <https://calmatters.org/explainers/california-gun-laws-policy-explained>
- <https://ota.org/sites/files/2018-06/G13-Gunshot%20Wounds.pdf>
- <https://www.researchgate.net/profile/Eng-Ooi-3/publication/320507430/figure/fig1/AS:571858104061952@1513353004013/Classification-of-anatomical-zones-of-the-neck-Monson-1969-Zone-1-extends-from.png>
- <https://www.nytimes.com/2019/02/14/opinion/sunday/gun-violence-hospitals.html>
- <https://media.gettyimages.com/id/98618210/photo/atlanta-emergency-room.jpg?s=1024x1024&w=gi&k=20&c=hxpydFKCOCDY8-5dhGgzeHVPIccWGu2NJ7bfWRLKCXA=>
- <https://www.statnews.com/wp-content/uploads/2022/08/GettyImages-1385481713-1600x900.jpg>
- <https://content.artofmanliness.com/uploads/2020/10/Treat-Impalement-1.jpg>
- [https://diabetes.org/sites/default/files/styles/hero\\_level2\\_desktop/public/2022-03/meds-treatments-pills-L2-hero.jpg?h=b48d56ad](https://diabetes.org/sites/default/files/styles/hero_level2_desktop/public/2022-03/meds-treatments-pills-L2-hero.jpg?h=b48d56ad)
- <https://www.ismp.org/sites/default/files/inline-images/20201203-figure1-A-B-IV-pole.PNG>