

# Emergency Trauma Surgery

Additional Surgical Techniques



# Lesson Objectives:

1. Explain the trauma system used in the United States
2. Describe the lethal triangle of trauma physiology
3. Discuss compartment syndrome
4. Describe the principles of Advanced Trauma Life Support (ATLS) trauma management
5. Explain what is meant by *damage control surgery*
6. Discuss the elements of case planning for common trauma surgeries

# Trauma Surgery and Trend

- Trauma is the leading cause of death in individuals aged 1 to 45 and the third leading cause overall.
- WHO predicts injury to be the top cause of death and disability across all age groups by 2020.
- Civilian trauma patients often arrive during off-hours, straining emergency resources.
- **Tasks of the Surgical Technologist:**
  - Assisting the surgeon during emergency procedures.
  - Maintaining sterile field integrity.
  - Facilitating communication and coordination among team members.

**Watch "Life in a Trauma Center" Video**

# Life in a Trauma Center Video



# Life in a Trauma Center Video

## **Summary of Video:**

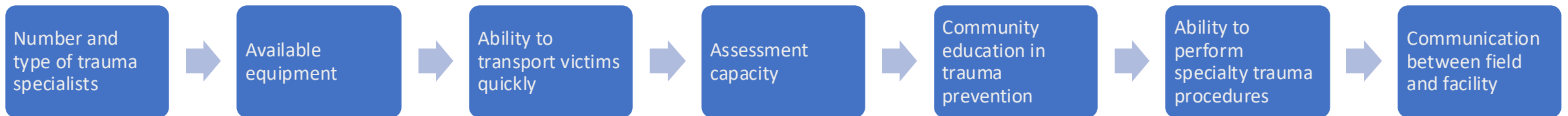
- Lots of team members working together quickly
- Stabilization of life threatening injuries
- One injury can lead to another
- High Level care between multiple disciplines and specialties

# Trauma Systems

- **Designation of Trauma Centers**

- Designated by numerical system: Levels I through V
- Criteria established by the Committee on Trauma of the American College of Surgeons and state laws

- **Criteria includes:**



# Trauma Centers and Certification

- **Level I Trauma Centers**

- Greatest capacity to handle all types of trauma
- Must have state-of-the-art equipment for real-time communication

- **Physician Certification**

- Achieved through American College of Surgeons' Advanced Trauma Life Support (ATLS) course
- Globally recognized
- Focuses on ATLS treatment guidelines and trauma management protocols



# Trauma Injuries



Unintentional  
Traumas

The diagram consists of two large, blue, stylized arrows pointing in opposite directions. The left arrow points to the left and contains the text 'Unintentional Traumas'. The right arrow points to the right and contains the text 'Intentional Traumas'. The arrows are positioned horizontally, with a gap between them, and are set against a white background.

Intentional  
Traumas

# Types of Traumas

## Unintentional Traumas

- Result from accidents or mishaps.
- Examples include automobile accidents, falls, bicycle accidents, and industrial accidents.
- Injury patterns are somewhat predictable.
- Often involve blunt trauma.
- Common in civilian populations.
- Typically not caused by deliberate human action.

## Intentional Traumas

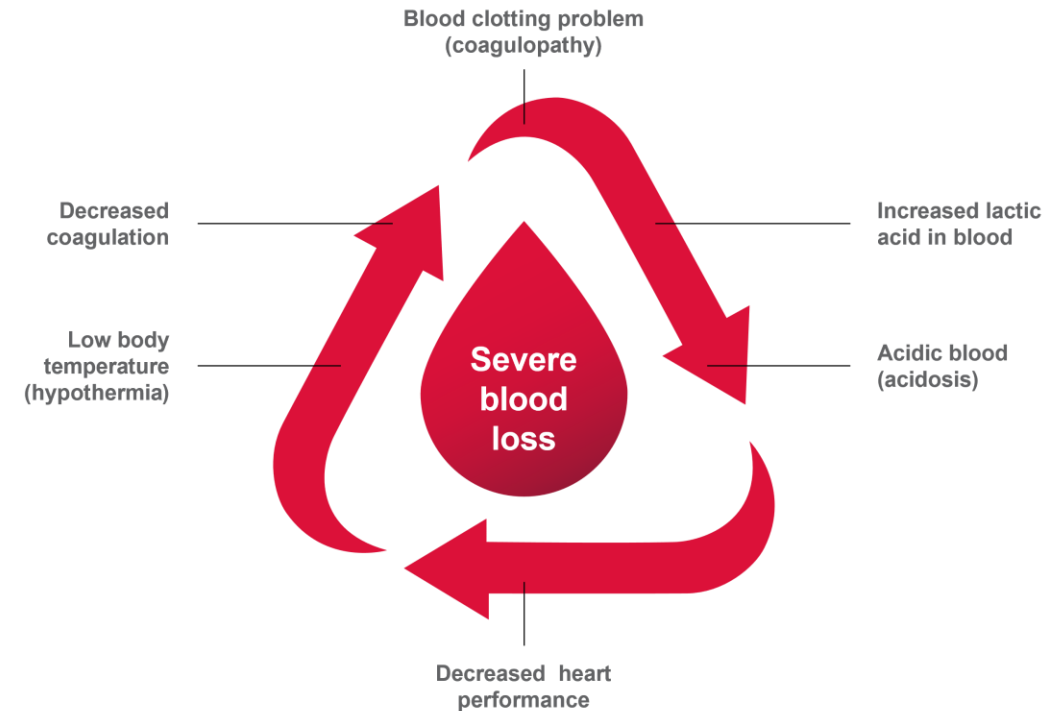
- Result from deliberate human actions.
- Examples include injuries caused by firearms, knives, and other weapons.
- Injury patterns may vary widely.
- Often involve penetrating trauma.
- Can include interpersonal violence and criminal activities.
- Result from purposeful intent to cause harm or injury.

# Trauma Pathophysiology

- Essential for informed decision-making in trauma management.
- Guides actions across all phases of treatment.
- Decision-making based on distinct parameters.
- Extent of surgery determined by critical factors.
- **Deviation from Standard Algorithms**
  - Necessitated by the complexity of physiological responses.
  - Surgeons and consultants often need to diverge from typical treatment pathways.

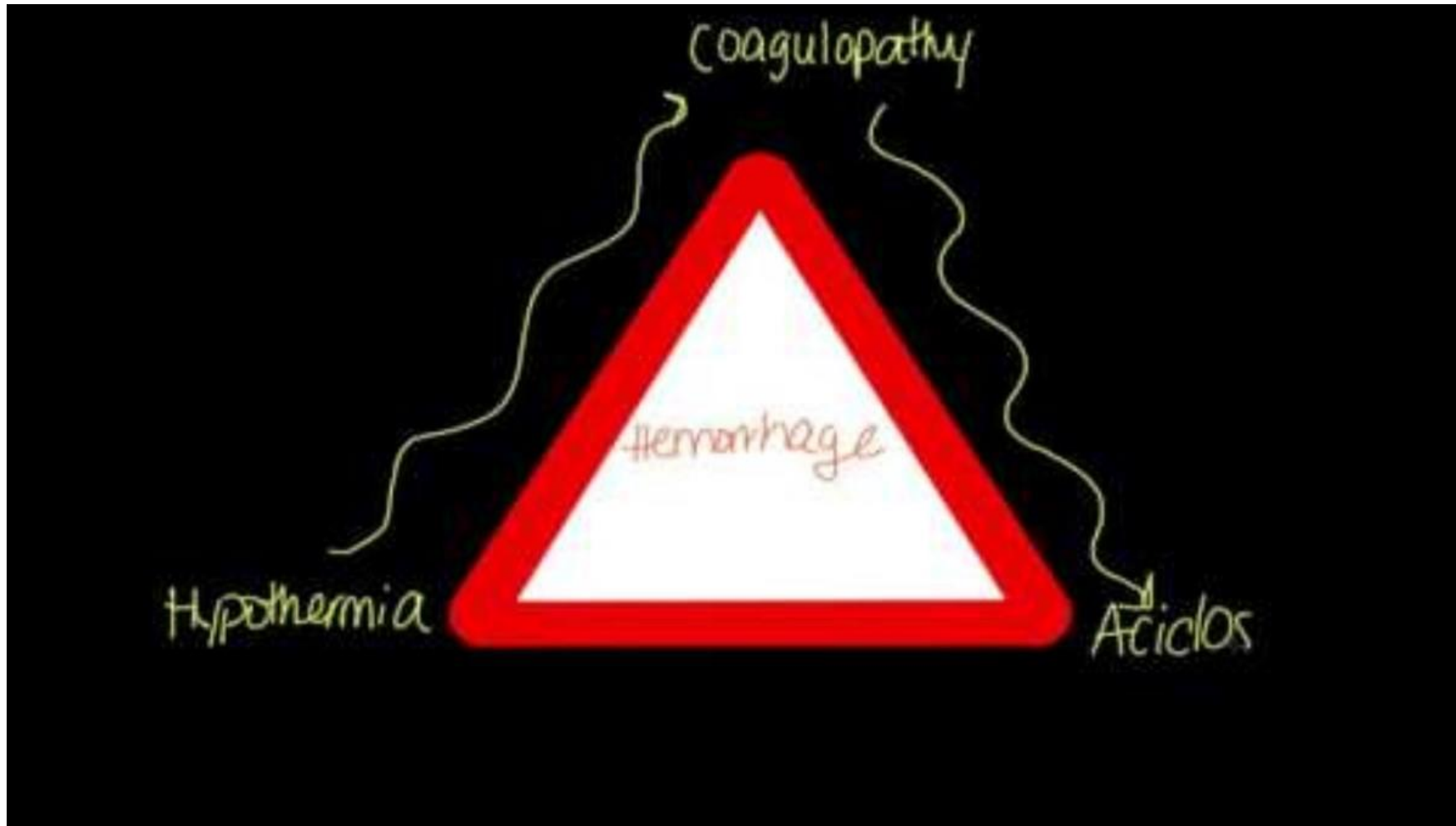
# The Lethal Triangle

- Three physiological conditions are a primary focus of assessment and decision making in severely injured patients.
- Also known as "Triangle of death, "lethal triangle, lethal triad"
- **Conditions Include:**
  - Hypothermia: Subnormal core body temperature for an extended period of time
  - Metabolic acidosis: Lower-than-normal blood pH
  - Coagulopathy: Potentially lethal disorder of the normal blood-clotting system



**Watch the "Lethal Triangle" Video**

# The Lethal Triangle Video



# The Lethal Triangle Video

## Summary of Video:

- Event that will lead to bleeding
- One factor will cause another
  - Positive feedback loop, one factor continually exacerbates another
- Stop the cause

# Compartment Syndrome

- **Definition:** Tissue swelling within a closed area, such as muscle bundles or the abdomen, leading to restricted blood flow and tissue necrosis.
- **Mechanism:** Compensatory mechanisms in acute injury cause tissue swelling, blocking circulation and depriving tissues of oxygen.
- **Affected Areas:** Commonly observed in the abdomen, limbs, and brain injury cases.
- **Symptoms:** Pain, swelling, numbness, and decreased sensation in the affected area.
- **Emergency Treatment:** Acute compartment syndrome (ACS) requires immediate surgical intervention to relieve pressure and restore blood flow.



**Watch the "Compartment Syndrome" Video**

# Compartment Syndrome Fasciotomy Video



# Compartment Syndrome Video

## Summary of Video:

- Compartment Syndrome caused by swelling of tissue
- Fascia holds and resists tissue, causing ischemia
- Incision into fascia to relieve pressure
- Closure later, when swelling has reduced

# Advanced Trauma Life Support Principles of Trauma Management

The clinical problem that is the most lethal (the greatest threat to life) is treated first.

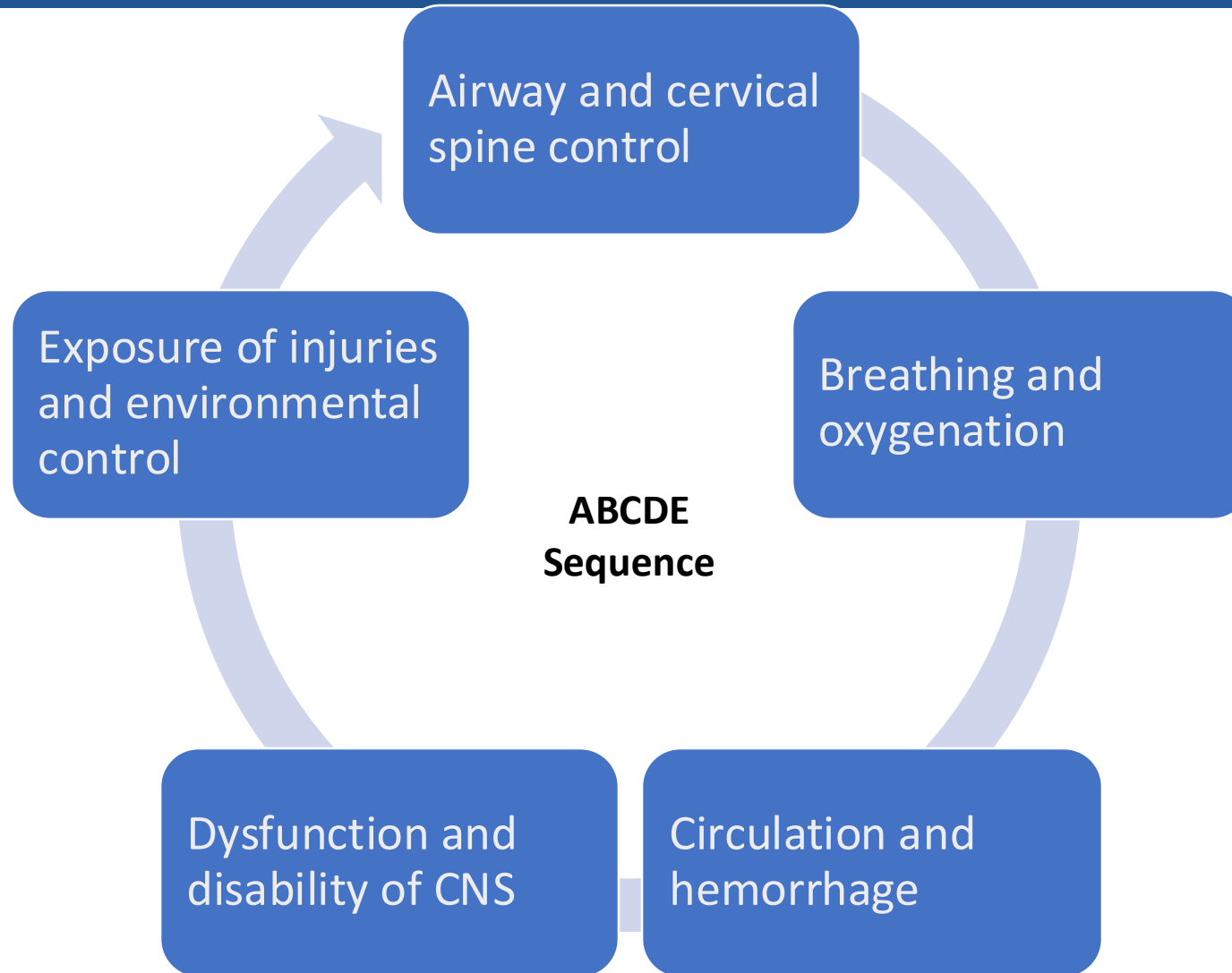
Treatment is initiated even when a definitive diagnosis (a diagnosis confirmed by assessment or investigation) is not established.

Treatment may be initiated even when there is no detailed history.

# Prehospital Care and the Golden Hour

- Takes place before arrival at trauma center
- Involves first responders: EMTs, trauma nurses, rescue personnel
- Occurs in the field and during transit
- **The Golden Hour Concept**
  - Critical hour post-injury
  - Trauma-related morbidity and mortality affected by time to resuscitation
  - 50% of victims with severe injuries die within minutes
  - 30% die in the first few hours
  - Hemorrhage is primary cause of death

# Field Care: The Primary Survey



# Resuscitation

- **Definition and Scope**
  - Restoring physiological balance
  - Treatment for effects of hemorrhagic shock
  - Continues across multiple phases of recovery
- **Objectives and Considerations**
  - Achieving and maintaining normothermia
  - Balancing intravascular volume
  - Careful monitoring and reevaluation needed
  - Use of large-bore venous cannulas for fluid infusion

# Hospital Care: The Secondary Survey

- **Overview**

- Performed once patient stable enough to be moved
- Immediate surgery may bypass secondary survey

- **Assessment and Interventions**

- Head-to-toe examination for less obvious injuries
- Investigations such as ultrasound, radiology, MRI
- Additional interventions: IV lines, urinary catheter, nasogastric tube

- **Importance of Verbal History**

- Obtained from patient or witnesses
- Assists in diagnosis and treatment planning



# Damage Control Surgery

- **Definition:**

- Specific surgical strategy for physiologically unstable patients.

- **Goal:**

- Focus on lifesaving maneuvers.

**Rationale:**

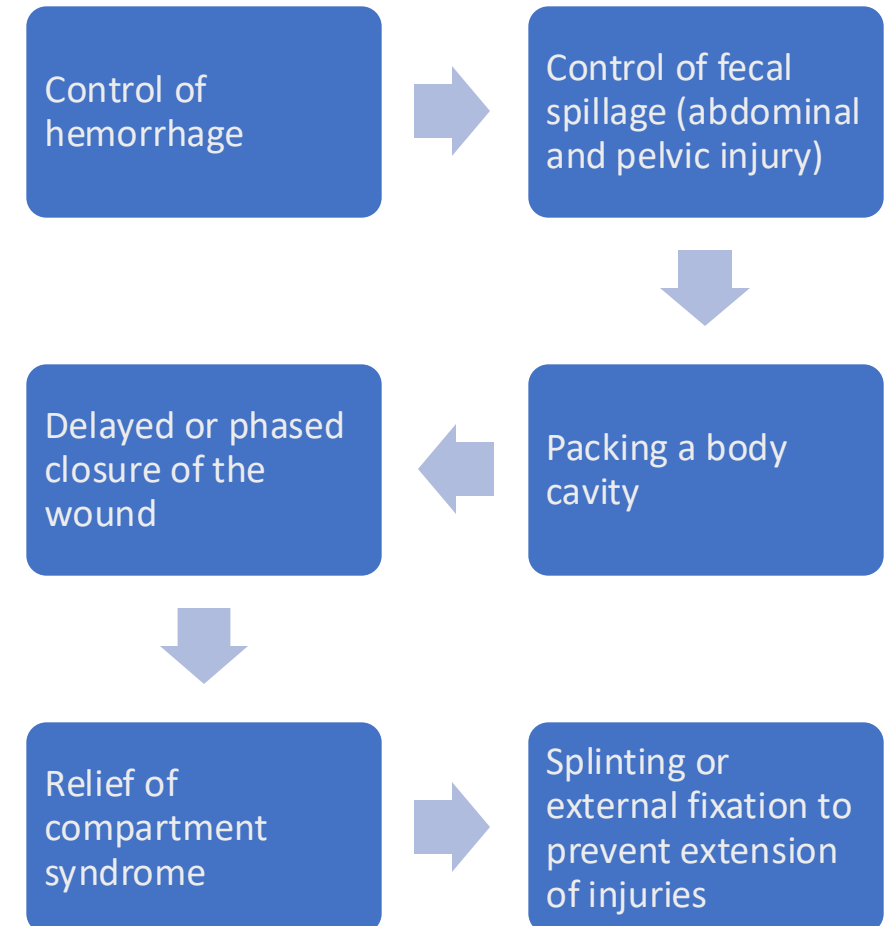
- **Physiological Instability:**

- Quick progression to shock, hypothermia, inadequate organ perfusion, and coagulopathy.

- **Immediate Concerns:**

- Exsanguinating hemorrhage
- Sepsis from wound contamination

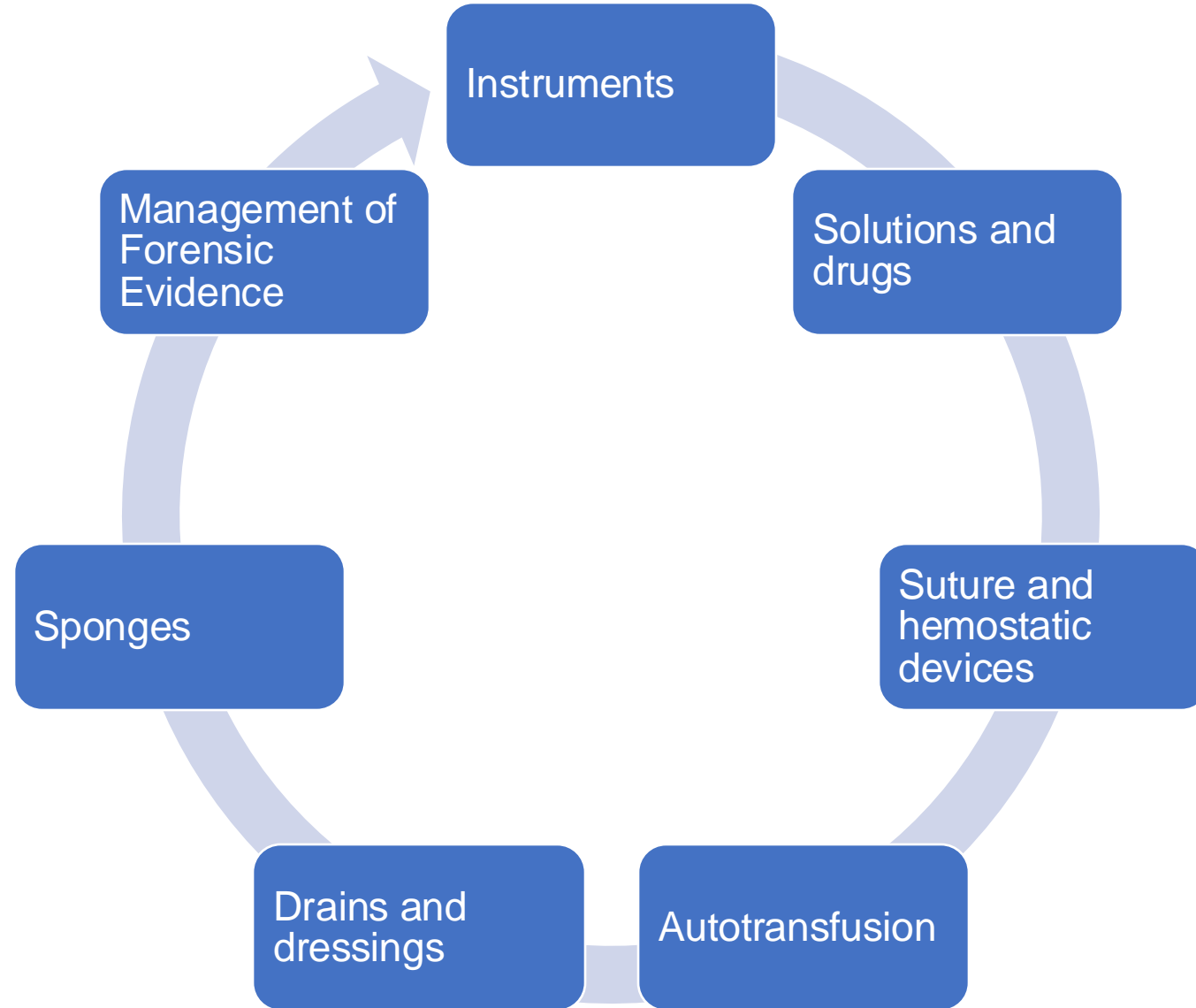
## Technique



# Areas of Application of Damage Surgery

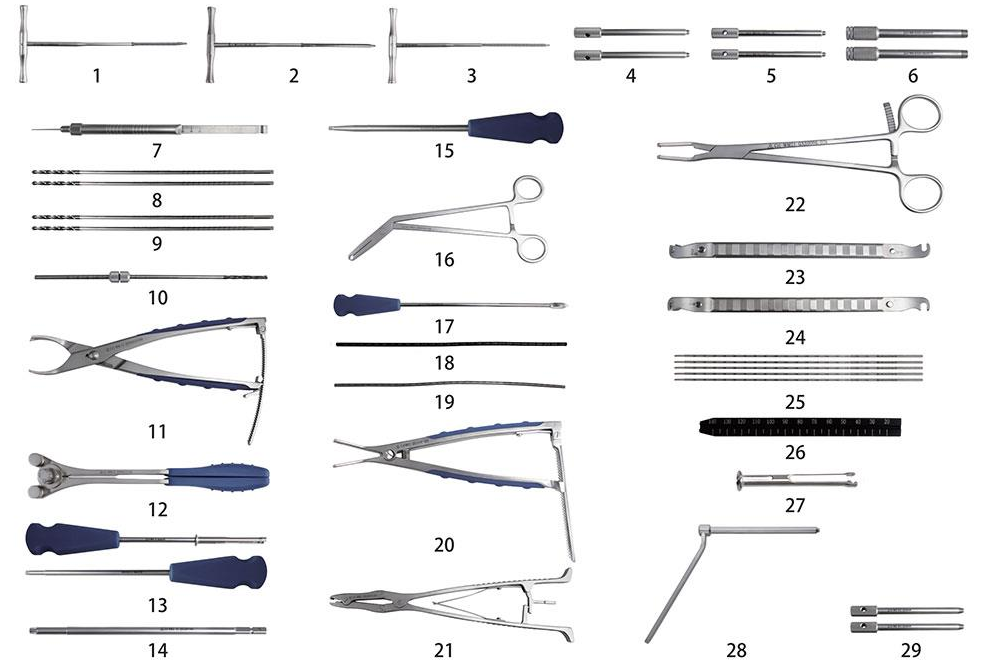
- Thoracic
- Abdominal
- Retroperitoneal
- Cranial
- Orthopedic

# Case Planning



# Case Planning – Instruments

- Start with basic instruments, modify according to systems involved.
- Specialty instruments kept unopened nearby for quick access.
- Multiple sets may be needed for multiple injuries or systems involved.



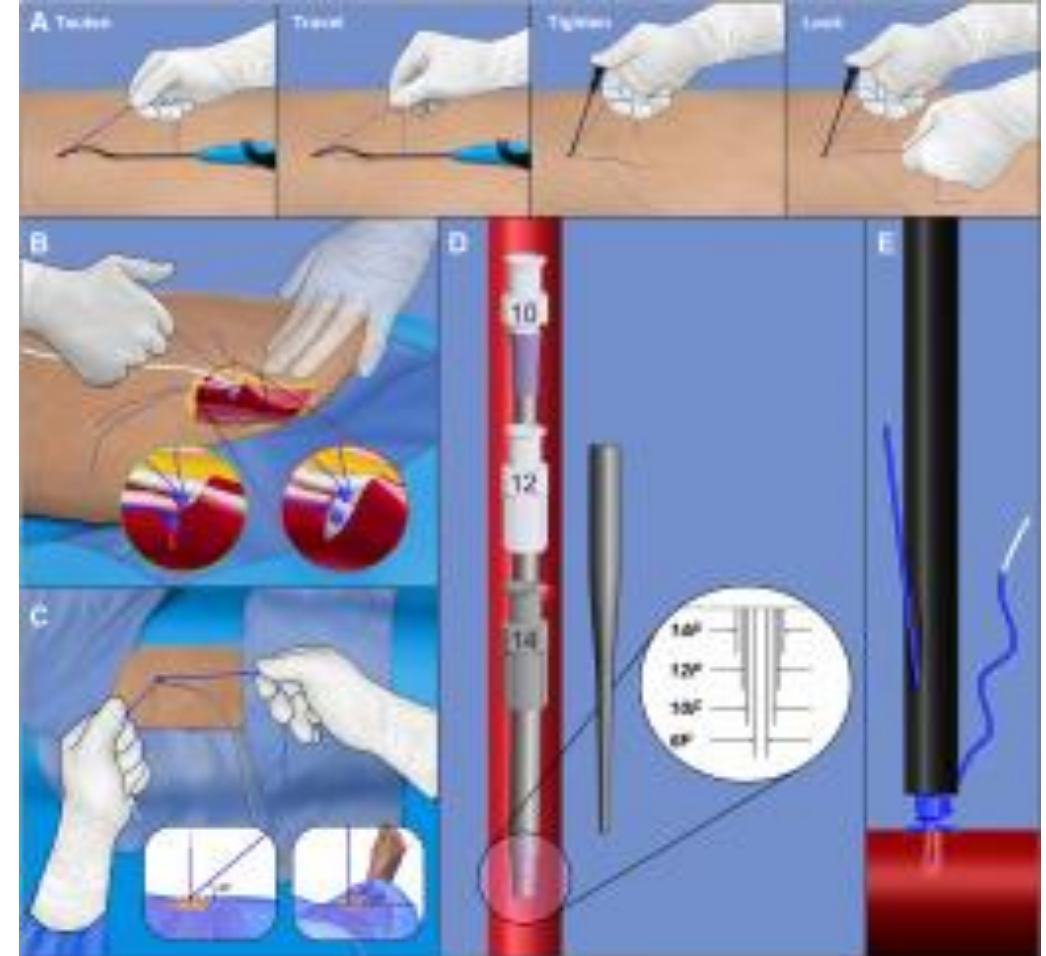
# Case Planning – Solution and Drugs

- Copious irrigation solution needed for tissue debris and foreign objects.
- Warm fluids required for major debridement.
- Antibiotic irrigation and warm solutions essential.
- Blood loss tracked with empty solution bottles.

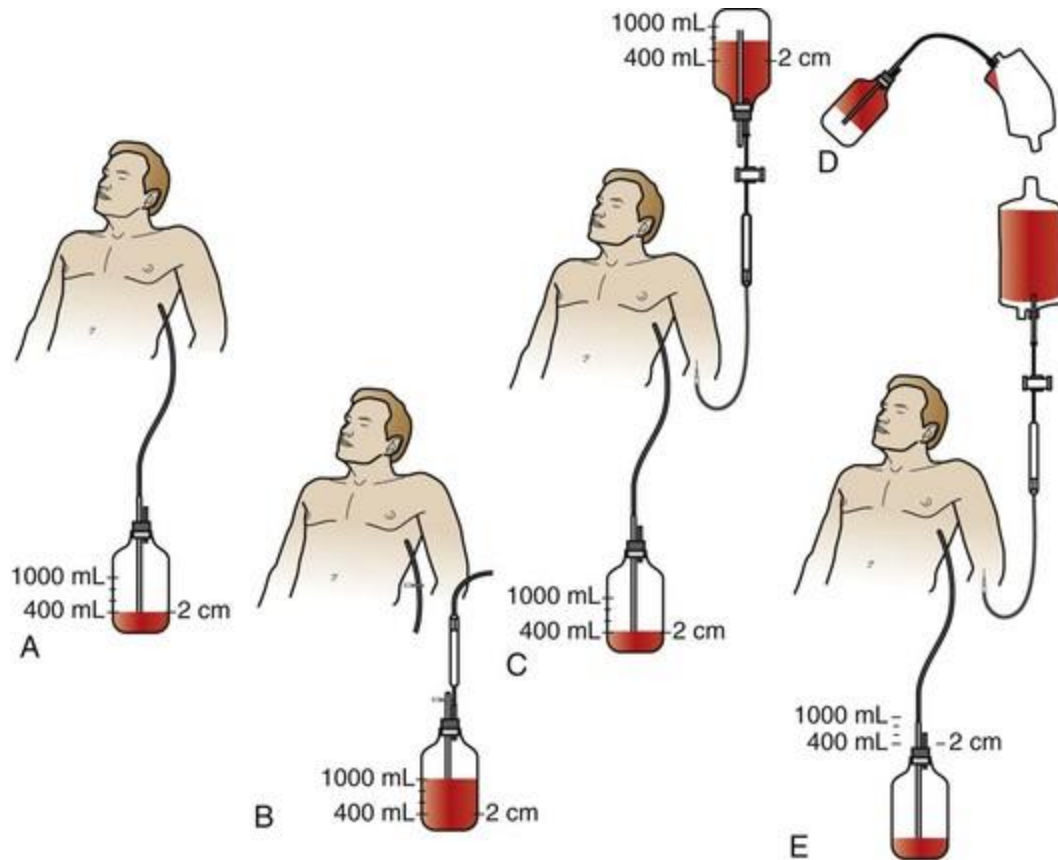
Table. Steps for Treating Preoperative and Postoperative Pain in Trauma Surgery Patients	
Mild pain	<ul style="list-style-type: none"><li>• Start with acetaminophen or NSAID</li><li>• Add mild opiate and/or an adjuvant as needed</li></ul>
Moderate pain	<ul style="list-style-type: none"><li>• Start with a milder or lower dose of opioid</li><li>• Add nonopioid and/or adjuvant as needed</li></ul>
Severe pain	<ul style="list-style-type: none"><li>• Start with a stronger or higher dose of opioid</li><li>• Add nonopioid and/or adjuvant as needed</li></ul>

# Case Planning – Hemostatic Devices and Sutures

- Choice depends on systems involved.
- Nonabsorbent sutures favored in open trauma cases.
- Electrosurgical units and topical hemostatic agents may be needed.



# Case Planning – Autotranfusion

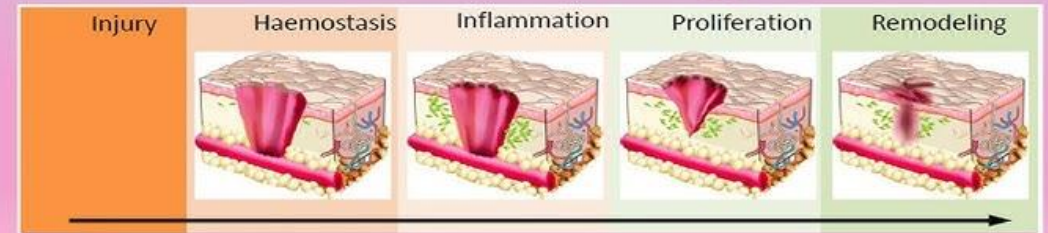


- Salvaging and reinfusion of blood at the surgical site.
- Setup includes equipment for collecting, rinsing, and filtering blood.
- Provides immediate availability of blood, especially in cases of severe hemorrhage.

# Case Planning – Drains and Dressings

- Wound drains control postoperative serosanguinous pooling.
- Closed chest drainage for thoracic wounds, various drain systems for abdominal and soft tissue trauma.
- Dressings and packing vary based on wound type and classification.

## Stages of Wound Healing



With Nurse Alyssa



# Case Planning – Sponges

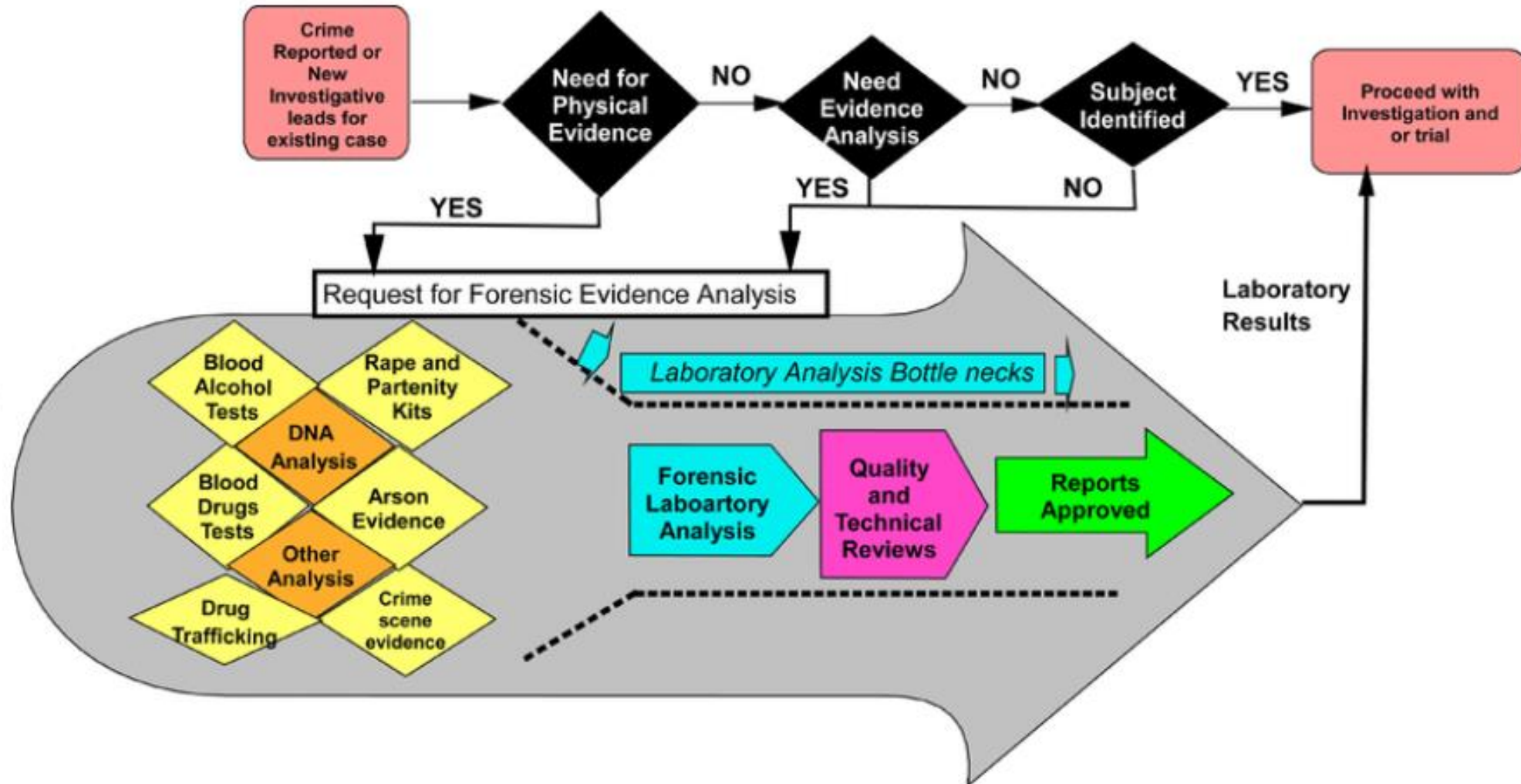
- Large quantities needed for trauma surgery.
- Practical methods for tracking sponges during emergency procedures.
- Techniques for wound packing and sponge management.



# Case Planning – Management of Forensic Evidence

- Surgical technologists may encounter forensic evidence.
- Guidelines for handling bullets, fragments, and ballistic items.
- Importance of preserving evidence and following correct handling procedures.

# Case Planning – Management of Forensic Evidence



# Preoperative Care

Slide 1 of 2

- **Moving and Handling:** Coordinate positioning; risk of exacerbating injuries; attention to spine stability; precautions include directed moves, maintaining stabilization devices, slow postural changes, and caution with pregnant patients.
- **Maintaining Patient Normothermia:** Priority for core temperature maintenance; minimize exposure, use warmed blankets, pre-warmed IV solutions, and control room temperature.
- **Airway:** Priority for anesthesia provider; emergency airway may need conversion; surgical assistance may be required.

# Preoperative Care

Slide 2 of 2

- **Continuing Physiological Evaluation:** Continuous assessment of physiological changes; repeat baseline tests at intervals; urgent tests communicated to lab upon arrival; efficient communication for test results and imaging studies.
- **Emotional Support:** Reassurance and orientation for conscious trauma patients; emotional comfort when feasible; providing updates and quiet space for family members.
- **Records and Consent:** Consent obtained as per hospital policy; documentation essential for continuity of care; collection of forensic evidence when necessary.

# Opening a Case and Sterile Setup

- Trauma surgery is not conducive to preplanning
- Extent of injuries is unknown
- Prepare items in order of use in a surgical emergency

The following is a suggested order:

1. Gowns, gloves, drapes arranged in the order of use
2. Draping completed
3. ESU, suction up
4. Light handles in place
5. Knife mounted and up
6. Four laparotomy sponges on the field, four in warm saline for immediate use
7. Superficial and self-retaining retractors up
8. Hemostats up

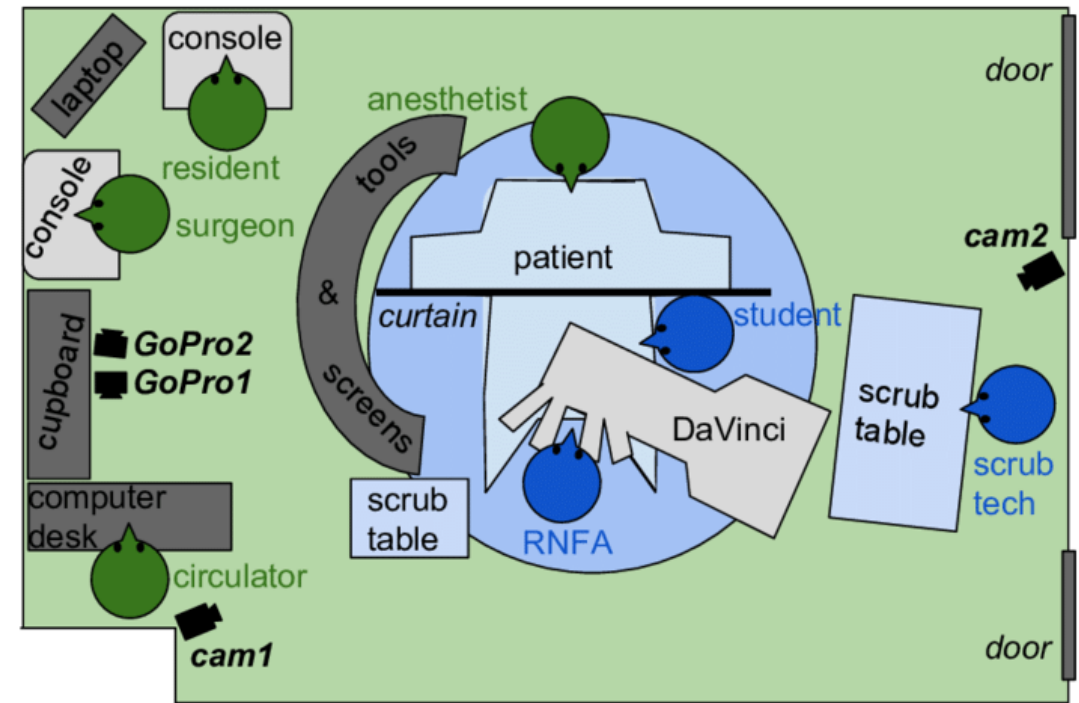
# Skin Prep and Draping

- Surgical team may choose to modify prep
  - Speed may often be more important than sterility
- Prep area isn't fully delineated
  - Povidone-Iodine Prep may be preferred – due to risk of fire with alcohol based prep dry times
- Fewer drapes used in the process



# Sterile Field Management in Trauma

- High level of attention to the wound and necessary supplies/instruments
- Trauma surgery tasks performed in order of priority
  - Incision
  - Suction
  - Control of Bleeding/Hemostasis
- Containment methods used to limit exposure





# Role of Scrubbed Surgical Technologist

- Provide efficient and safe assistance in surgical procedures.
- Carry out typical scrub role tasks while anticipating immediate needs.
- Example: prioritizing retraction over hemostasis unless bleeding is exsanguinating.
- Achieve hemostasis through suture ligatures or anastomosis.
- Predictable process even when entire procedure steps are unclear initially.

# Role of ST in Infection Control and Rapid Procedural Changes

## Infection Control

- Infection is the second leading cause of mortality in trauma patients.
- Use containment methods during surgery to limit tissue exposure to contaminants.
- Employ bowel technique, debridement, and irrigation to prevent sepsis.
- Predictable techniques allow proactive planning by surgical technologist.

## Rapid Procedural Changes

- Be prepared for sudden changes in surgical course, such as occult injuries or deteriorating patient status.
- Maintain vigilance over the wound while performing other tasks.
- Examples: clearing instruments, preparing supplies.

# Emergency Surgical Procedures

- **Emergency Surgical Procedures Include:**

- Laparotomy with staged closure
- Orthopedic trauma
- Thoracic injury
- Major peripheral vascular trauma
- Injuries of the brain and spinal cord



**Watch "Life in the Trauma Unit" Video**

# Life in the Trauma Unit Video



# Life in the Trauma Unit Video

## **Summary of Video:**

- Trauma Bay communicates directly to the OR
- Teams work Quickly
- Communication is key
- Standardized Setups, clear delineated roles and responsibilities
- May be emotionally difficult

# Laparotomy With Staged Closure

- **Overview**

- Abdominal trauma is a leading cause of morbidity and mortality across all age groups.
- Blunt trauma (e.g., motor vehicle accidents, falls) and penetrating wounds (e.g., knife, gunshot) are common causes.

- **Damage Control Laparotomy**

- Rapid exploration to identify and control hemorrhage sources.
- No reconstruction unless necessary.
- Abdomen packed, left open, and protected.

- **Diagnostic Approaches**

- Stable patients: CT scan or FAST.
- Unstable patients: Immediate surgery prioritized over definitive diagnosis.

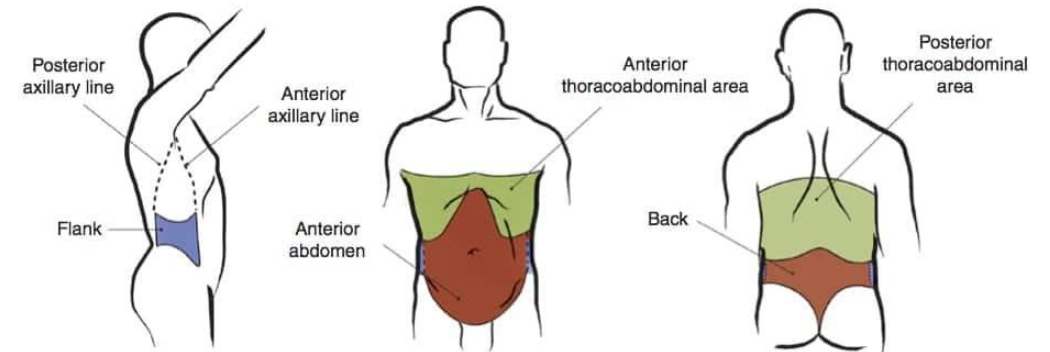
# Case Planning for Abdominal Trauma

- **Instrumentation**

- General surgery or laparotomy set.
- Extra-long instruments for adult patients.
- Vascular clamps.

- **Exposure**

- Self-retaining retractors (e.g., Bookwalter).
- Handheld wide Deaver and Richardson retractors.





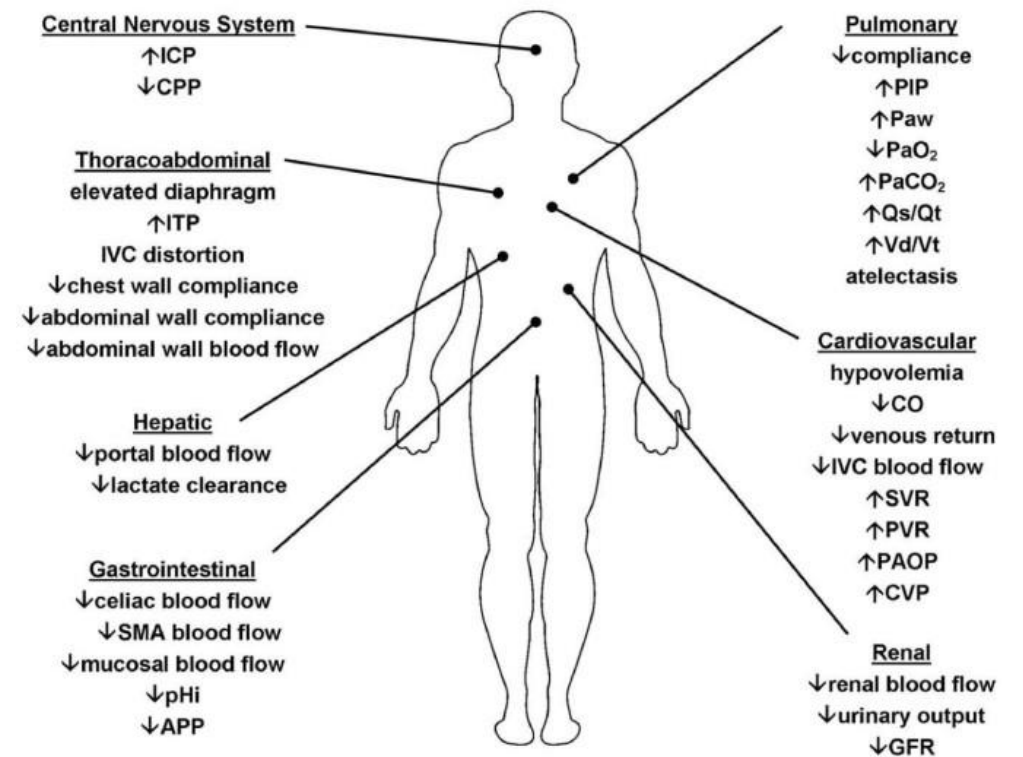
# Abdominal Compartment Syndrome (ACS)

- **Overview**

- Emergency response required.
- Edema in closed compartments (including abdomen).
- Elevated intraabdominal pressure leads to tissue ischemia, breathing obstruction, and other complications.

- **Treatment**

- Immediate surgical opening of abdominal cavity.
- Temporary closure to prevent ACS.



# Damage Control Techniques (Abdomen)

- **Procedure**

- Abdomen evacuated for blood, clots, and fluid.
- Packing of quadrants with laparotomy sponges.
- Meticulous repair avoided.

- **Common Injuries**

- Liver, spleen, pancreas, small intestine, mesentery.

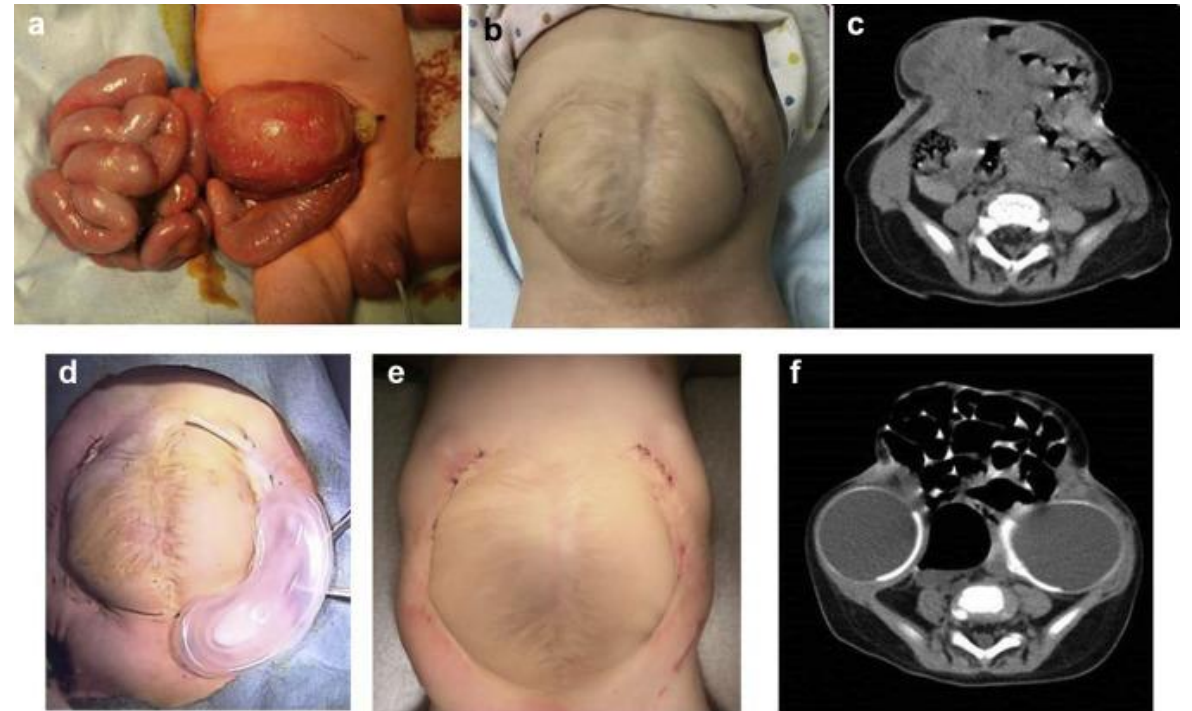
# Staged Abdominal Closure

- **Management**

- Abdomen left open for initial stabilization.
- Methods of protecting abdominal contents vary.

- **Protection Methods**

- Plastic pouch/bag enclosure.
- Plastic drapes.
- Closed vacuum suction (wound VAC).



# Orthopedic Trauma

- **Indications for urgent damage control surgery:**
  - Near amputation
  - Crushing injury
  - Potentially septic trauma
  - Pelvic fracture
- **Objectives of early intervention:**
  - Prevent further injury related to vascular and soft tissue damage
  - Decrease risk of sepsis
  - Prevent or treat compartment syndrome
  - Decrease blood loss
- **Surgical priority:** Stabilization of bones



# Preoperative Care of the Orthopedic Patient

- **Potential complications:**
  - Life-threatening hemorrhage
  - Infection from open fractures
  - Neurological injury
  - Vascular damage, compartment syndrome, limb loss
  - Loss of limb function
- Prevention and treatment of complications
- Role of surgical technologist in presurgical care
- Preoperative debridement and emergency surgery protocols
- Management of pelvic fractures and limb traction

# Damage Control Orthopedic Surgery

- **Goals:**

- Control hemorrhage
- Stabilize fractures
- Prevent sepsis

- **Wound management highlights:**

- Assist in maintaining hemostasis
- Prepare appropriate-size instruments
- Maintain clean, orderly field
- Keep tissues moist
- Strict aseptic technique

- **Debridement of Fractures**

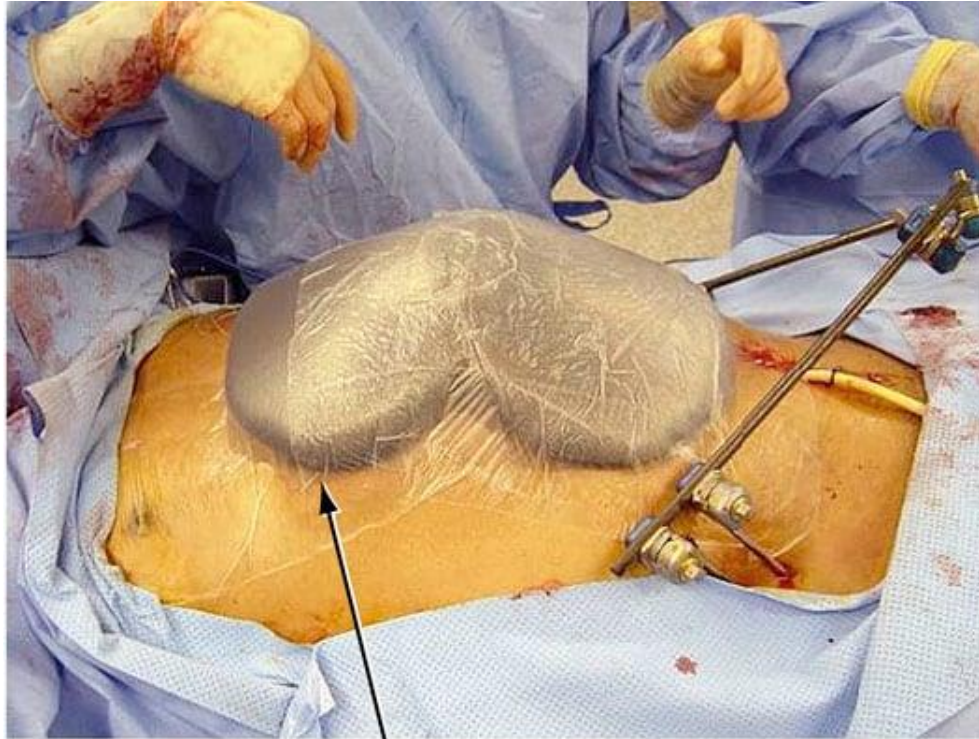
- Definition and necessity
- Procedure and instrumentation
- Wound irrigation and preparation
- Importance of tissue viability

- **Emergency Treatment of Fractures**

- Role of external fixation
- Priority of hemorrhage control
- Management of unstable pelvic fracture
- Stabilization of long bone fractures

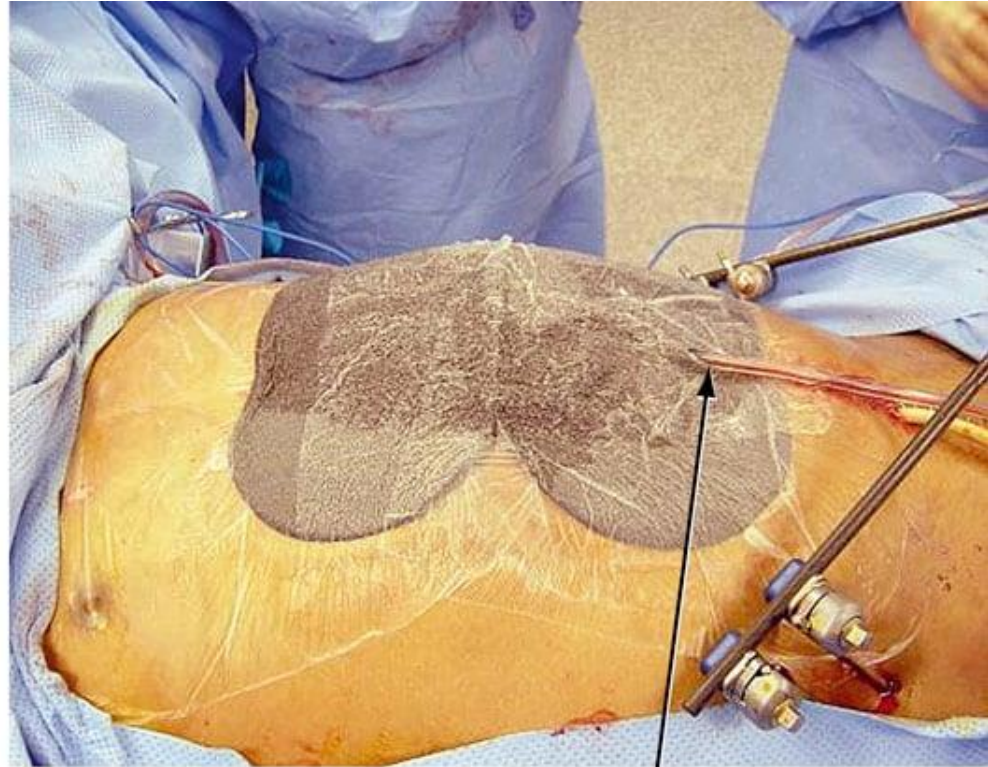


# Vacuum-Assisted Closure (VAC)



E

The black sponges are affixed  
with an occlusive dressing

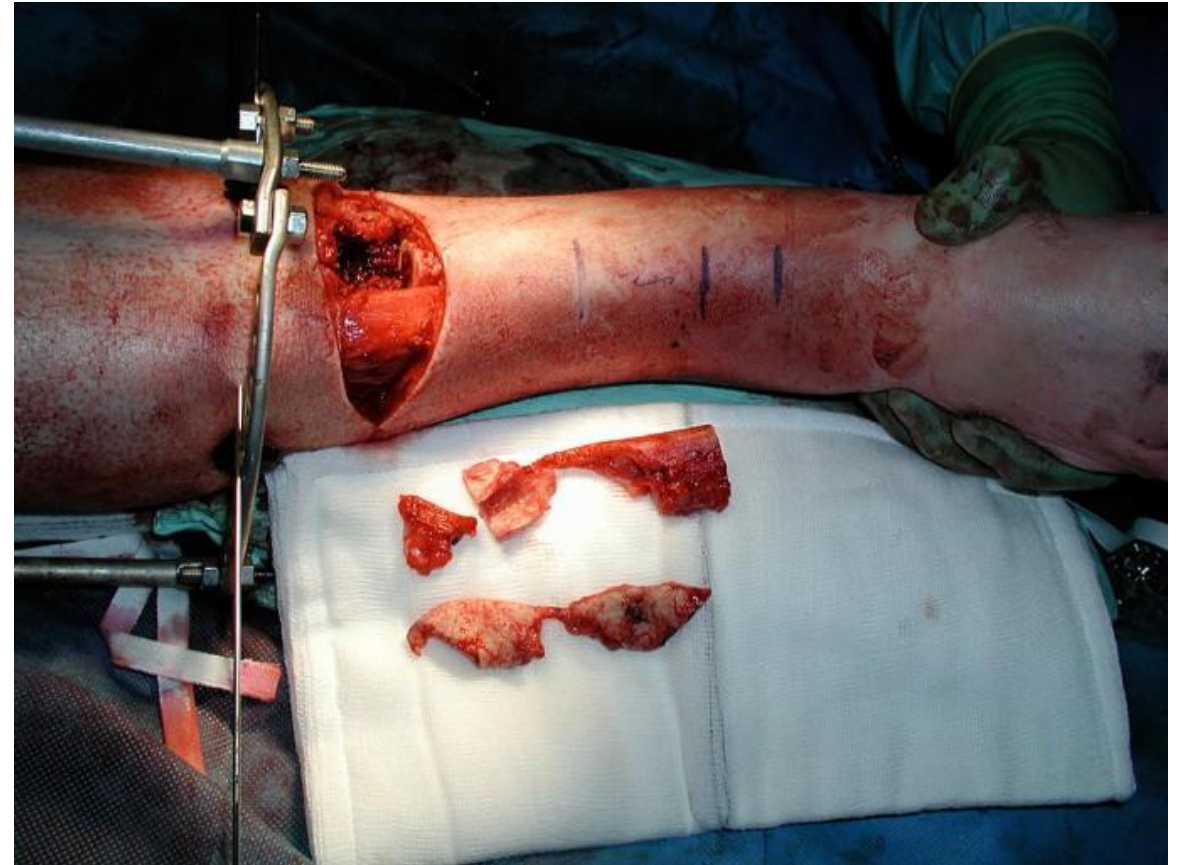


F

Standard suction tubing is placed

# Fractures

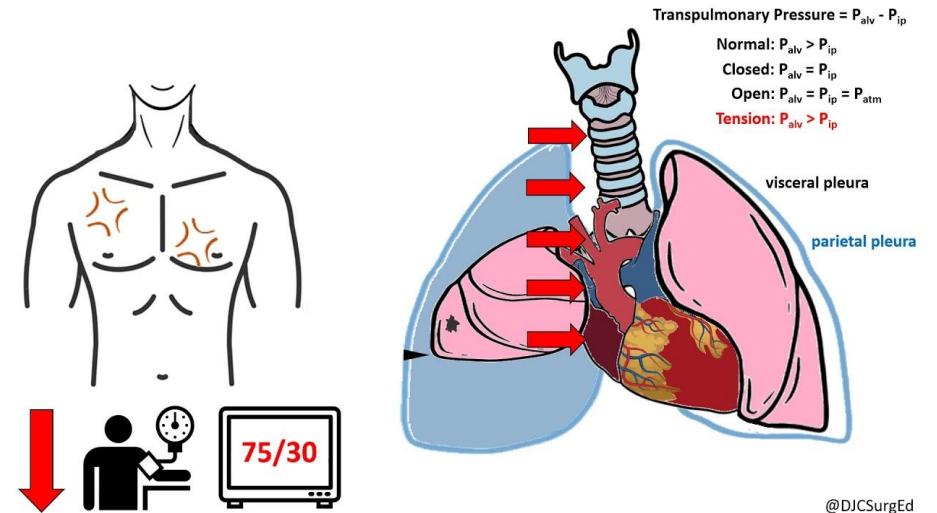
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# Thoracic Injury

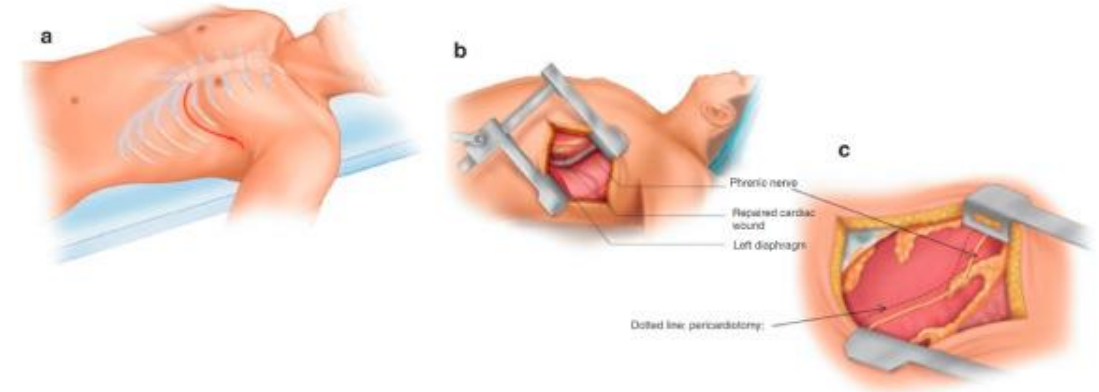
- **Blunt thoracic injury:** 20% of trauma mortality
- **Main cause:** Motor vehicle accidents
- **Life-threatening injuries:**
  - Mechanical impingement on respiratory and cardiac function
  - Injury to heart, great vessels, lungs, and soft tissues



# Thoracic Injury

## Open Thoracotomy in Emergency Department

- **Purpose:** Evacuate cardiac tamponade, control hemorrhage
- **Indications for immediate surgical intervention:**
  - Tension pneumothorax
  - Open pneumothorax
  - Flail chest
  - Massive hemothorax
  - Pericardial tamponade



# Thoracic Injury Case Planning

- **Instruments and supplies for:**

- Cardiovascular
- Respiratory
- Orthopedic systems

- **Injuries of the Chest Wall**

- Importance of chest wall integrity
- Immediate measures for open chest wall injury

- **Cardiovascular Trauma**

- Blunt Cardiac Rupture
- Penetrating Cardiac Wound
- Aortic Injury

- **Pulmonary Trauma**

- Types of pulmonary trauma:
- Pulmonary contusions
- Flail Chest
- Pneumothorax
- Hemothorax
- Lacerated Lung

# Major Peripheral Vascular Trauma

- Major arterial trauma poses immediate threat to limb viability and vital structures.
- 70-90% of peripheral vascular injuries in the US result from penetrating trauma, notably gunshot wounds.
- Male population, particularly aged 15-34, constitutes 90% of victims.
- **Assessment and Diagnosis**
  - Severity determines assessment method upon arrival.
  - Severe cases with pulsating hemorrhage proceed directly to operating room.
  - Diagnostic tools: Color flow Doppler, CT scan, MRI, considering time constraints.

# Types of Vascular Trauma

## Penetrating Trauma:

- Mainly from gunshot and knife wounds, trajectory and wound characteristics studied for effective treatment.

## Blunt Trauma

- Result of crushing injuries, like motor vehicle accidents or fractured long bones

# Case Planning and Treatments

- **Case Planning and Surgical Preparation**

- Urgent surgery setup includes vascular and general surgery instruments.
- Vascular sutures prepared for direct repair and anastomosis, grafting avoided.
- Forced cooling protocol may be implemented for limb ischemia.

- **6. Surgical Treatment Priorities**

- Preoperative measures focus on hemorrhage control and resuscitation.
- In severe cases, amputation may be necessary.
- Surgical priorities: Exposure, vessel access, hemorrhage control, resuscitation, bone/foreign body removal.

## REMINDER: BOOK YOUR FIRST COACHING SESSION NOW!

If you have not scheduled your first coaching session by now, schedule it now for personalized support, career related guidance, and understanding the practical side of the program.

Click on the coaches tab on the right side and schedule your session!



# Read Chapter 35 from the E-book

Read **Chapter 35** from your E-Book to pass the upcoming quiz from **Surgical Technology - Elsevier eBook on VitalSource, 8th Edition**.

[Click Here](#) to read chapter 35!



# Thank you!

Get ready for your quiz and rest of the activities now. Best of luck!



# Congratulations!

Lesson 35 is complete.