### WOUND MANAGEMENT MARCH PAWS



### **OVERVIEW**



#### •Burns

#### Penetrating Eye Trauma

•Soft Tissue Injuries

Abdominal Injuries

### **LEARNING OBJECTIVES**



Please Read Your

#### **Terminal Learning Objectives**

#### And

**Enabling Learning Objectives** 



## Anatomy of the Skin



The skin is the protective barrier against the environment:

Prevents fluid loss

Helps regulate body temperature

Prevents infection

### Anatomy of the Skin



Composed of 3 layers

Epidermis

Dermis

Subcutaneous



### Epidermis



#### Composed of 5 stratae

- Basale
- Spinosum
- Granulosum
- Lucidum
  - Only present in the hands and the feet
- Corneum
  - Comprised of keratinized ('dead' cells)



### Dermis



Primarily made up of dense irregular connective tissue that cushions the body from stress and strain

Contains:

- Mechanoreceptors (sense of touch)
- Thermoreceptors (sense of heat)
- Hair follicles
- Sweat glands
- Sebaceous glands
- Apocrine glands
- Lymphatic vessels
- Nerves
- Blood vessels



### Subcutaneous



Mainly used for fat storage, thermoregulation, and shock absorption

Contains:

- Fibroblasts (collagen and role in wound healing)
- Adipose Cells (fat cells)
- Macrophages (immune cells – phagocytosis)





### **Depth of Burns**



- Burn depth is classified by which layers of the skin are damaged, the full extent of which may not be determine until 24 - 48 hours after the event
- 1st Degree (Superficial)
- 2nd Degree (Partial Thickness)
- 3rd Degree (Full Thickness)
- 4th Degree (Complete)



### 1<sup>st</sup> Degree



Damage only to the epidermis

#### **Signs and Symptoms**

- Painful to touch
- Erythema
- Blanching with pressure
- Minimal swelling



## 2nd Degree

 Damage to the epidermis and dermis

#### **Signs and Symptoms**

- Deep, intense pain
- Moist and reddened skin
- Blisters or open weeping wounds
- Moderate edema, possible fluid loss



## **3rd Degree**



 All layers of skin have been damaged

#### **Signs and Symptoms**

- Pain at periphery, no pain near center
- 1st and 2nd Degree burns around periphery
- No blanching or capillary refill
- Dry, leathery appearance
- Color range (Pale Yellow, Cherry Red or charred)



### **4th Degree**



### Burns that penetrate all layers of skin and muscles, fat, bone, and internal organs







### **TYPES OF BURNS**



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SPMH1 Sherif PO2 Mohannad H, 1/6/2021

### Thermal



- Most common type on the battlefield
  - Flame/Incendiary weapons
  - Munitions
  - Blasts



- Primary effect of these weapons
  - Expose the body to superheated gases and flames that cause severe burns

### Thermal



- Strong potential for airway burns
  - Personnel in bunkers, ship compartments, or armored vehicles



### Thermal



- Airway burns may result in rapid life-threatening swelling and obstruction of the upper airway.
- Monitor the casualty for :
  - Stridor or hoarseness
  - Oropharyngeal swelling/ difficulty swallowing
  - Blackened sputum
  - Singed nasal or facial hair
  - Dyspnea

### Electrical





- May be more severe than expected
- Small entrance and exit wounds
  - Large area of tissue damage below the surface and along the path of the current

### Electrical



- Degree of damage is related to:
  - Amount of current
  - Duration of exposure



Contact electrical burns. The knee on the left was energized, and the knee on the right was grounded.



Electrical burn on hand and arm.

### Electrical



- Large release of chemicals from destroyed muscle.
  - Cardiac arrhythmias
  - Kidney failure



Arm with third degree burn from high-voltage line.



## Circumferential

- Burn that encircles the trunk of the body or an extremity
  - Can produce life or limb threatening condition
  - Create tourniquet-like effect.



## Circumferential



- Circumferential chest burns can constrict chest expansion and lead to respiratory cessation
- Escharotomies are surgical incisions made to allow expansion



### Radiation



- Associated with nuclear blasts
- Exposed skin is burned by infrared rays emitted at detonation
- Clothing/Shelter offer some protection
- Secondary 1<sup>st</sup> & 2<sup>nd</sup> degree burns
- Secondary source burns
- Systematic effects



### Chemical



- Occurs when skin contacts a corrosive chemical agent
  - Direct chemical destruction of tissue
  - Alkalis, Acids, Organic, Blister



### Chemical









#### • Alkali Burns

# THE DEFICIENCE AND THE PRODUCTION OF THE PRODUCT

## **Critical Burns**

- Critical regardless of depth or TBSA affected:
  - Injuries of the respiratory tract, other soft tissue injuries, and musculoskeletal injuries
  - Partial thickness burns > 10% of the TBSA
  - Full thickness burns in any age group
  - Any burn involving face, hands, feet, genitalia, perineum, or major joints
  - Electrical burns, including lightning injury
  - Chemical burns



### **Burn Percentage**



- Burns are categorized by the percentage of body surface that is damaged
- Important for calculating fluid replacement needs
- Two Methods
  - Rule of Nines
  - Rule of Palms

## **Rule of Nines**



- Useful for adults and children over the age of 10
- Divides Total Body Surface Area (TBSA)
  - Areas of the body are multiples of 9%
  - The groin is equal to 1%





## Rule of Palms



- Useful for small or irregular burns
- The TBSA is estimated by approximating the number of 'Palms' it would take to completely cover the burn
  - Assumes the palm of the <u>patient</u> represents approximately 1% of the TBSA


#### Treatment

- Stop the burning process
  - Water is a good method
  - Smother the flames with jacket or blanket
  - Roll the casualty on the ground
- Estimate depth and extent burned
  - Use Rules of Nines or Palms
- Maintain ABC's
  - Two large-caliber IV catheters are required for burns that cover more than 20% of the TBSA

#### Treatment



- Perform a Detailed Assessment
  - Skin burns are not immediately fatal, complete assessment for additional injuries and treat them appropriately
- Dress the burn
- Prevent Hypothermia
  - Keep PT warm!

#### Treatment



#### Pain management

- Should be provided to burn victims, and small doses of narcotics should be titrated intravenously.
- Vital signs and respiratory effort are monitored for potential adverse effects. (Note: The use of narcotics is contraindicated in head and spinal trauma.)
- Water immersion may be applied for 10-15 minutes for pain relief, however, caution should be used as it may intensify shock.



- Hypovolemic shock will result from massive fluid shifts associated with burns
  - If hemorrhagic shock is also present, resuscitation for hemorrhagic shock takes precedence over resuscitation for burn shock
- If burns are greater than 20% of Total Body Surface Area, fluid resuscitation should be initiated as soon as IV/IO access is established.



- The resuscitation of burn shock is aimed at
  - Restoring the lost volume
  - Replacing anticipated lost volume
- The objective is to calculate and replace the fluids that it is anticipated the casualty will lose over the first 24 hours



- Initial resuscitation
  - Lactated Ringers
  - Normal Saline
  - Hextend
    - No more than 1000 ml should be given of Hextend
    - Follow with Lactated Ringers or Normal Saline PRN

















## Burns - Eyes



- Assess and treat burns to the eyes
  - Blurry vision
  - Vision loss
  - Pain
  - Tearing
  - Conjuctival erythema





## **Treatment - Eyes**

- Irrigate with copious amounts of fluid
- Cover with dry, sterile dressing
- If patient can see and can ambulate, do not dress the eye
- Avoid dressing both eyes, if only one is burned







# **USAISR Rule of Ten**



For adults weighing 40-80 kg: % TBSA x 10cc/hr

- Calculate the Total Body Surface Area burned and round it to the nearest 10
  - Example: 36% would be rounded to 40%
- This is then multiplied by 10 to get the number of cc per hour of fluid needed
  - Example: 40% x 10 = 400cc/hr



For every 10 kg **ABOVE** 80 kg, add 100ml/hr to initial rate

(% TBSA x 10cc/hr) + (100cc/hr ((wt - 80kg)/10)) Example: Patient is 110kg with 36% TBSA

- (36% x 10cc/hr) + (100cc/hr ((110kg-80kg)/10))
- (40% x 10cc/hr) + (100cc/hr (30kg/10))
- 400cc/hr + (100cc/hr (3kg))
- 400cc/hr + 300cc/hr
- 700cc/hr



## **Eye Injuries**



Check visual acuity (from best to worst)

- 1. Able to read print
- 2. Can count the number of fingers held up
- 3. Can see hand motion
- 4. Can see light

# **Eye Injuries**

- Cover eye immediately with a rigid eye shield
  - NOT a pressure patch
- If the rigid eye shield is not available, an intact set of protective eyewear may be placed on the casualty





# **Eye Injuries**



- If shrapnel is suspected, removal can wait several days as long as aggressive antibiotic therapy is provided and the injury to the eye is repaired as soon as possible
- Have the casualty take 400mg moxifloxacin from their combat pill pack
- TACEVAC as soon as possible

## Impaled Eye



- Do <u>NOT</u> remove the object
- Make a thick dressing and cut a hole in the center the size of eye opening
  - Pass dressing over impaled object
- Position crushed cup over dressing and bandage in place
- Elevate head to decrease intraocular pressure

## **Protruding Globe**



• Do <u>NOT</u> attempt to place the eye back in socket

• Apply bulky dressing around eye, moist gauze over the globe and cover with a cup secured in place

Monitor and TACEVAC



# **Soft Tissue Injuries**



Involve the skin and underlying musculature

Two categories

- Closed
- Open

# **Closed Wounds**



- An injury where there is no open pathway from the outside to the injured site
  - Strains, sprains and dislocations (covered in the Fractures lesson)

#### Treatment

- Supportive strapping or bandaging
- Immobilize by splinting so that affected muscle is in relaxed position, if injury is severe.
- R.I.C.E. (Rest, Ice, Compression, Elevation)

## **Closed Wounds**











Injury where the skin is interrupted or broken, exposing tissues underneath

### Abrasions



- Also known as 'road rash', 'rug burn', and 'mat burn'
- Superficial scratches of the skin surface
- Oozing blood from injured capillaries
- Painful due to nerve ending damage



#### Abrasions



#### **Treatment**

- Cleanse the wound
- Cover injury with a small bandage
- Prevent infection use anti-bacterial ointment



#### Lacerations



- Wound produced from the tearing of body tissue
- A blow from a blunt object
- A cut from a sharp object
- Can be smooth or jagged
  - Tear, cut, or gash



#### Lacerations







#### **Treatment**

- Hemorrhage control
- Immobilization if major tendons and muscles are severed
- Treat for shock
- TACEVAC as needed

### Avulsions



• Flap of skin that is torn loose or completely pulled off.





## Avulsions



#### **Treatment**

- Control bleeding, apply dressing to avulsed area
- Replace flap
- If completely torn off:
  - Wrap in saline soaked gauze or pack in ice
  - Transport with the patient
  - Immobilize extremity as indicated

#### **AVULSIONS**







"Degloved" finger, caused by forcible removal of tight ring. Sandzen, Atlas of Acute Hand Injuries, 1980.

#### **Traumatic Amputations**



- Non-surgical removal of limb or appendage
- There may be less bleeding when blood vessels spasm and retract

#### **TRAUMATIC AMPUTATIONS**




#### **Traumatic Amputations**



#### **Treatment**

- Hemorrhage control
  - Tourniquet to control life-threatening hemorrhage
- Preserve amputation in sterile dressing
  Pack in ice and send with patient
- Treat for shock
- TACEVAC ASAP



# **Neck Anatomy**

- Skull attaches to the cervical spine via the Atlas (C1) and swivels due to the axis (C2)
- There are a total of 7 cervical vertebrae





# **Neck Anatomy**

- The soft tissue consists of:
  - Arteries and Veins
  - Lymph nodes
  - Muscles
  - Subcutaneous fat
  - Skin
  - Cartilage
  - Neural network







# **Structure Injuries**



Injury to the associated anatomy of the neck

#### **Signs and Symptoms:**

- Subcutaneous emphysema
- Hematemesis
- Hemoptysis
- Dysphagia
- Dyspnea
- Hoarseness
- Deformity

# Vascular Injuries



Injury to the carotid arteries and/or jugular veins

Signs and Symptoms:

- Hemorrhage
- Hemoptysis
- Hematemesis

### Treatment



- C-Spine precautions (assume injury)
- Control Sucking Neck Wounds
- Apply pressure to bleeding areas
- Consider cricothyroidotomy for airway
- Fluid resuscitation
- TACEVAC



# **Abdominal Injuries**



- Abdominal injuries are easily overlooked and can quickly cause death in a trauma casualty
- Early deaths typically result from internal hemorrhage due to damage to the great vessels
  - Later deaths can be attributed to:
    - Septic shock
    - Organ failure
    - Slower bleed that lead to hypovolemia



- The abdominal cavity is clinically divided into four quadrants
  - Right Upper (RUQ)
  - Left Upper (LUQ)
  - Right Lower (RLQ)
  - Left Lower (LLQ)



 This aids in injury determination based on pain and localization of symptoms



#### • RUQ

- Transverse Colon
- Right Kidney
- Pancreas small portion
- Liver
- Gallbladder

#### • LUQ

- Transverse Colon
- Left Kidney
- Pancreas
- Spleen
- Stomach



#### • RLQ

- Ascending Colon
- Small Intestine
- Major vasculature for right leg
- Appendix
- Right Ovary

#### • LLQ

- Descending Colon
- Small Intestine
- Major vasculature for left leg
- Left Ovary







# Solid Organs

- Solid masses of tissue
  - Liver
  - Pancreas
  - Spleen
  - Kidneys



- Highly vascular
  - Injury results in severe bleeding

# Hollow Organs



- Hollow internally without any solid or liquid mass that enables them perform important functions
  - Stomach
  - Intestines
  - Bladder
  - Uterus and fallopian tubes
- Bleeding is generally minimal
- Rupture causes septicemia and toxicity

# **Abdominal Injuries**



- Abdominal Injuries can be caused by:
  - Blunt Trauma
  - Penetrating Trauma

 Assessing the patient for abdominal injuries begins with knowledge of the MOI

## **Blunt Trauma**



- Great threat to life because injuries are more difficult to diagnose
- The injuries to abdominal organs result from either compression or shear forces

# Penetrating Trauma



- Penetrating trauma is more readily visible than blunt trauma
  - Can give a rough mental visualization of the potential trajectory
- A foreign object enters the abdomen and opens the peritoneal cavity to the outside
- Multiple organ damage can occur in penetrating trauma



### Assessment



- Determine the Mechanism of Injury (MOI)
  - You saw it occur
  - Someone with the casualty saw it occur
- Note any protective gear worn by the casualty
- Protective equipment should be removed, if feasible, to fully assess the casualty

### Assessment



- Signs that raise the index of suspicion are:
  - Mechanism of injury
  - Soft tissue injuries to the abdomen, flank, or back
  - Shock without an obvious cause
  - Level of shock greater than explained by other injuries

#### **SIGNS AND SYMPTOMS**



 Unless there are associated injuries, casualties with abdominal trauma generally present with a patent airway.

 Inspect and palpate; look and feel for soft tissue injuries and distention.

## Inspect



- Look for: deformities, contusions, abrasions, punctures, bleeding, tenderness, lacerations, swelling, and unusual findings such as evisceration or pulsating masses
- Any abnormalities found should be exposed and examined in greater detail

## Auscultate



- Auscultation of bowel sounds is generally not a helpful field assessment tool
  - There may be too much noise to hear anything
  - Cannot be managed in the field
- Time should not be wasted to determine their presence or absence as this diagnostic sign will not alter the field management of the casualty

# Palpate



- Palpate each quadrant to identify areas of tenderness
  - Use a wave like motion with your hands stacked and fingers closed
  - Start with the heel of your palm and continue to your fingers
  - Do not dig in with your fingertips; try to avoid any pinpoint pressure
  - Do not exert too much pressure with your palpation

# Palpate



- Note signs of 'voluntary guarding'- when the associated abdominal muscles tense up when palpated
  - Serves to protect the patient from pain

#### Abdominal tenderness:

- Involuntary guarding
- Percussion tenderness
- Diminished or absent bowel sounds
- Rebound tenderness





#### TREATMENT

## Treatment



- Maintain ABC's
- Establish baseline vital signs
- DO NOT strongly palpate the abdomen
- Place in supine position with knees slightly flexed if feasible
- Treat for shock
- Monitor and TACEVAC

# Penetrating Objects



- Do <u>NOT</u> remove impaled objects
  - Leave in place
  - Secure with bulky dressings
- If intestines are <u>NOT</u> exposed
  - Apply dry, sterile dressing



# **Penetrating Objects**



If intestines <u>ARE</u> exposed:

- Apply moist sterile dressing soaked in normal saline
- Gently secure eviscerated bowel
- Treat for shock
- <u>DO NOT</u> probe for objects
- Monitor and TACEVAC







### DEMONSTRATION



#### **WOUND MANAGEMENT**



