Burn Injuries and First Aid

The Adult and Pediatric Burn Institute

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Objectives

- Describe various types of burn injuries in the workplace
- Review initial emergency response for initial treatment and care
- Discuss prevention strategies
- Describe post-injury care

The Adult and Pediatric Burn Institute at Akron Children's Hospital

- *Based on a burn critical care and plastics model*
- *Treat both children and adults*

- *Inpatient*
  - 250 admissions in 2024, 30% children less than 18 years
  - 3 deaths
- *Outpatient*
  - Over 950 new patients seen
  - 3,300 visits
  - 49% children <18 years

Background

- Declared a Regional Burn Center in 1978
- Verified by the American Burn Association (ABA) and the American College of Surgeons
- Continual reverification
- 23 + county area
- Pennsylvania and West Virginia
- Treat more than just burn injuries
  - Skin disorders (Steven-Johnson)
  - Wounds
  - Dog bites

Programs

Community

- Juvenile Firestoppers
- Safety Towns
- Prevention Awareness

Professional

- ABLS
- Presentations
- Lectures

Support

- ACBC Fund
- Summer Burn Camp
- Burn Survivor Support Group
- Burn Survivor Retreat Weekend
- Annual Holiday Program

- Back to School Program
- Back to Work Program

Why Burn Centers?

- Not a common injury
- Extremes of age less tolerant of burn injuries
- Inappropriate resuscitation with intravenous fluids associated with increased morbidity and mortality
- Wound care
- Disaster planning
  - Involved with reporting bed burn availability to the ABA for country-wide preparation if there is a disaster including burn patients

Advances

- Resuscitation
- Improvement in critical care
- Early excision
- Spray on skin; skin substitutes

- Single most important factor
  - PREVENTION

Mortality Rates Incidence

- More than 480,000 patients annually in the United States receive medical treatment for burn injuries
  - 45,000 hospitalized
  - 3,200 deaths: majority due to residential fires
- About 75% of the deaths occur at the scene or during initial transport
- Death rate is highest among children < 5 yr. and adults > 65 yr.

- Can be fatal, incapacitating, or disfiguring

In the Workplace Facts

- ***Prevalence:*** Between 10-45% of all burn injuries occur in the workplace
- ***Incidence:*** According to OSHA, workplace fires and explosions kill 200 and injure more than 5,000 workers each year
- ***Common causes:*** Hot liquids (scalds), open flames, electrical contact, chemical exposure, faulty equipment, and explosions
- ***High-risk occupations:*** Firefighters, food service workers, electrical technicians, industrial plant workers
- ***Burn types:*** Thermal burns (most common), chemical burns, electrical injury
- ***Impact on work:*** Workers can miss several days of work due to burn injuries, with more severe burns causing temporary or permanent disability

- Leading cause of DALYs (disability-adjusted-life-years)

Anatomy of the Skin

- Largest organ of the body
- Multiple functions
  - Protection from infection
  - Temperature regulation
  - Identity
- Divided into layers
  - Epidermis
    - Outer most layer, 0.005 inch
    - Provides function and anti-genicity
  - Dermis
    - Supporting base, 0.020-0.025 inch
    - Dermis can be replaced

Classification

- 1st Degree
  - Involves epidermis only
  - Surface of the skin is pink
  - No blisters
  - Painful
  - Heals in 2 – 5 days
  - No scarring, can have some residual redness or pinkness for a while, but natural color returns
  - Most often treated with Aloe gel

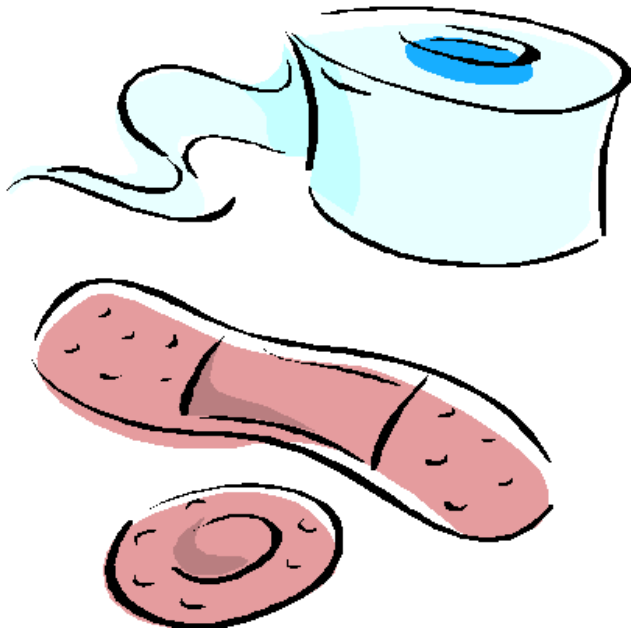
Classification

- 2nd Degree
  - Both epidermis and dermis involved
  - Area pink or red and looks ‘moist’, blisters noted
  - Very painful
  - Healing time can vary:
    - Up to 3 weeks or more
    - Some scarring can be noted (everyone heals individually). More scarring noted as you get closer and beyond 21 days to heal
  - Subdivided into two classifications:
    - Superficial 2nd degree – heals before 21 days
    - Deep 2nd degree – takes longer that 21 days to heal

Classification

- 3rd Degree
  - Involves all the layers of the skin and tissue underneath
  - Most serious type of burn injury
  - Color is waxy white, brown, or charred
  - Appears dry, tight, and leathery
  - Destroyed the hair follicles, sweat glands, nerve endings and skin buds
  - Will not heal on its own
  - Nerve endings will grow back-more sensitive to hot/cold and touch
  - The person will not grow hair or sweat where there was a 3rd degree burn

First Aid



Minor Burn Injuries

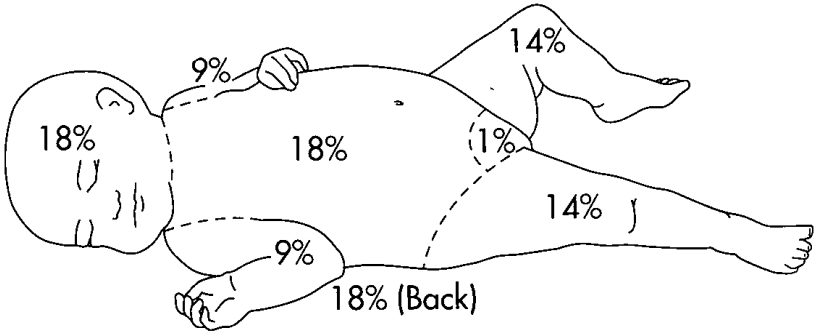
- Classified as 1st and 2nd degree
- TBSA less than 10%, however…
  - Age of the patient
  - Location of injury
  - Type of agent
- No noted complications
  - Infection (cellulitis)
  - Uncontrolled pain
  - Take into consideration patient's health

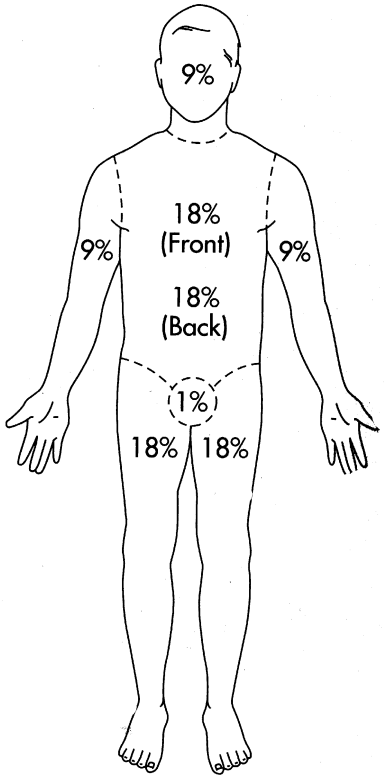
Palmer Method

- Uses victim's hand size (palm and fingers) to estimate % of TBSA with small or scattered burns
- The palmer surface represents roughly 1% in all age groups

Percentage of Body Injured

- *Rule of 9's*





First Aid

- Remove any clothing from the injured area
- Cool the area with cool water
  - Do not use ice or ice packs
  - Do not break any blisters
- If can be treated: clean the burn if there is any dirt or debris (do not delay sending a patient to clean the burn)
- Treatments
  - Aloe gel
  - Bacitracin ointment IF the blister is open,
  - Cover loosely with a clean gauze pad or band aid
- Do not use petroleum jelly, butter, or home remedies
- Tylenol/Motrin for pain
- Can be treated in an outpatient setting

Advice/Treatment

- Based on Assessment
  - Depth, extent of injury
  - How the injury occurred
  - Ability to care for the injury
- Treated at home/Come in
- Wound Care
  - Cleaning of the wound
  - What to do with blisters
  - Dressings
- Medications
  - Tetanus
  - Pain medication

Large BurnTreatment

- Initial response
  - Safety measures
  - Emergency processes at the facility
    - Chemical
    - Electrical
- Make sure the patient is breathing
- Remove clothing
- Cool the burn
- Apply a clean sheet or blanket
- Keep patient calm, warm
- Determine the extent of injury
- Call 9-1-1 to transport the patient

First Responders

Primary and Secondary Survey

A = Airway with C-spine protection

B = Breathing and ventilation

C = Circulation, cardiac status

D = Disability, neurological deficit, and gross deformity

E = Exposure, examine, environment, etiology

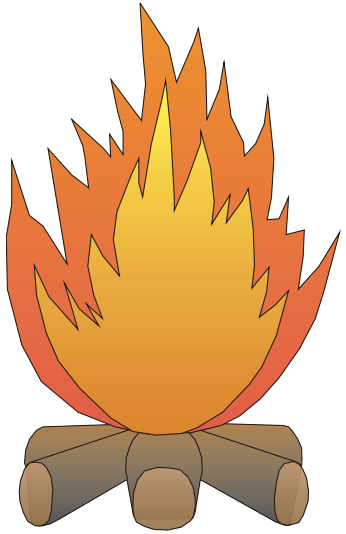
Many factors to consider: Inhalation, other trauma, how to transport the patient

Emergency Response Plan

- Designate a burn response team
- Have clear procedures for first aid and medical attention
- Establish evacuation routes and assembly points
- Conduct regular emergency drills to ensure preparedness

The most common burn sources …

- Thermal
- Chemical
- Electricity
- Cold



… how do we treat it?

Thermal Injuries

- Caused by heat sources
  - Some type of fire/flame and hot objects
- Use water
  - By spray with low pressure
  - May immerse in cool water
- Remove clothing, jewelry

Contact Burn

- Caused by a hot object ‘touching’ the skin
- Depth depends on how long the object was in contact with the skin
- Can involve the muscle
- Cool the area

Hot Liquids

- Also referred to as scald burns
- Includes steam
- Remove clothing
- Cool the area
- Do not break the blisters

Industrial Temperatures

• Rinse waters	180°
• Salt baths	400°
• Hot molds	170 - 400°
• Heat activated laminators	1200°

Third degree burn takes 3 seconds to occur at a temperature of 140 °

Tar, Wax, and Metal

- Immerse area in cool water
- Do not attempt to remove the agent if does not peel off easily
  - Very painful
- Elevate area to reduce swelling
- Patient needs medical assistance
- Most often the patient goes to surgery to get the tar removed

Chemical Injuries

- Considered environmental emergencies
  - Contain the spill
  - Do not be downwind
  - Identify the chemical
- Alkalis, acids, and organic compounds
- Flush the area with water
  - Do not use any neutralizers-this causes a heat reaction and makes the burn deeper
- Remove clothing, jewelry
- Brush dry chemicals off
- Break blisters

Alkalis

- Lye, cement, fertilizers, stain remover, refrigerant
- Causes liquefaction
- Chemical penetrates deep into the tissue

Acids

- Sulfuric acid, hydrochloric acid, nitric acid, hydrofluoric acid
- Coagulation necrosis
- Causes leathery eschar

- Fluoride binds free calcium in blood resulting in potentially life-threatening hypocalcemia

Organic Compounds

- Phenols, creosote, petroleum products
- Dissolves fat in cell membranes
- Absorption can cause organ injury to multiple systems (pulmonary, renal, hepatic)

- Many times, the skin can be discolored, but the injury is severe

Electrical Injury

- Results from exposure to an electrical current
- Electricity takes the path of least resistance
- Two basic forms of current
  - DC: flows in one direction only
  - AC: reverses direction of flow at regular intervals
- Can cause tetanic muscle contractions which may ‘freeze’ the victim to the source

Electrical Injury

- Conductive injuries
  - “Tip of Iceberg”
  - Contact points may be small
  - Massive tissue damage

Electrical Injury

- Damage can result in:
  - Flash, contact or thermal injury
  - Deep tissue full thickness burns
  - Compartment syndrome: muscles start to swell, enclosed in a fibrous sheath that does not give. Puts pressure on veins and arteries that stops the blood flow. Must surgically intervene to release the pressure
  - Associated injuries such as fractures due to technic muscle contracture where long bones involved
  - Cardiac rhythm disturbances
  - Sudden death

Lightning

- Risk is 1:280,000
- Kills 80 to 100 people annually
- Associated with a 30% mortality and 70% of survivors suffer serious complications
- Not associated with deep burns
  - ‘Feathered’ effect noted
- Causes deep polarization of the entire myocardium
- Significant cardiac and neurological damage

Cold Injuries

- Blood vessels in the skin constrict
- Results in a decreased blood flow to the skin
- The fluid in and around the skin cells develop ice crystals
- Rapidly rewarm the area with tepid water
- Do NOT rub the affected area (crushes ice crystals and causes more damage)

Prevention Strategies

- **Protective Equipment:**
  - Wear heat-resistant gloves, sleeves, aprons, face shields, and safety glasses depending on the task
  - Ensure equipment is properly fitted and maintained
- **Work Practices:**
  - Label hot surfaces clearly
  - Avoid reaching over hot surfaces
  - Use tools designed to handle hot materials
  - Make sure the floor is dry
  - Check the temperature of hot liquids before handling
  - Maintain proper distance from open flames
  - Use caution when working with chemicals
  - Make sure the electricity is cut off before working with an item
  - Watch where ladders are placed avoiding overhead wires

Prevention Strategies

- **Training and awareness:**
  - Educate employees about burn hazards specific to their work area
  - Train on proper handling of hot equipment and chemicals
  - Teach employees how to respond to a burn emergency
- **Key areas to focus on:**
  - **Kitchen environments:** Proper use of oven mitts, potholders, and splash guards
  - **Industrial settings:** Handling hot machinery, molten metal, and high-pressure steam
  - **Chemical handling:** Following safety protocols for chemical storage, handling, and disposal
  - **Outdoor work:** Protection from sun exposure, including wearing appropriate clothing and sunscreen. Weather conditions with lightning, snow, and cold temperatures. Placement of equipment in relation to power lines

Post-Injury Care

- Depends on the type of injury
  - Minor
  - Major (large)
- Any minor burns that do not need surgical intervention usually heal within 3 weeks
- Large burn injuries or those that need surgical intervention depends upon:
  - Degree of injury
  - Location
  - Surgical intervention
  - Scarring
  - Contractures and releases
  - Further surgical intervention
  - Physical therapy

Grafting

- Skin taken from a good part of the body (donor site) and then applied to the injured area after the area has been surgically debrided
- Any area can be used as a donor except for the front of the face
- Grafted areas will not sweat or grow hair since these appendages were destroyed
- Sensation will be ‘different’ due to nerve ending injury

Restrictions

- Inability to resume previous work position
- Environment
  - Construction workers with outside activities
  - Anyone who works in a warmer environment
  - Necessary clothing for work
  - Necessary clothing for their burn injury
- Functional limitations
  - Hand injuries
  - Contractures
  - Amputations
  - Endurance: may need an adjustment time to return for an 8- or 12-hour shift

?? Questions ??

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