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# Module 9:
# Burn Emergencies

Heather Hartney RN

# SPECIFIC OUTCOMES

- Describe the assessment and classification of burns
- Discuss current trends in cleansing and dressing of burns
- Apply the medico-legal aspects pertaining to burn management with regard to the emergency nurse
- Apply the above mentioned knowledge when analyzing a case scenario (paper and real life)
- Discuss fluid requirements of the patient with a burn injury
- List the drugs used in your unit to manage burn injuries
- Delineate the nursing process in the management of a patient with burn injuries

# ADVANCES IN BURN TREATMENT

- Fluid resuscitation
- Inhalation injury
- Wound care practice
- Early debridement and excision
- Increased nutritional support

# Risk factors

- Very young and very old have a high risk of death
- Burns in combination with an inhalation injury always worsen a patient's prognosis

# Prevention

- Smoke alarms
- Advise on possible risk factors and provide solutions

# Pathophysiology

- Initiates the inflammatory response
  - Heat
  - Redness
  - Pain
  - Localized and systemic edema formation

# Edema

- Amount of edema correlates with the depth, extent of injury (TBSA burn), and fluids administered.
- Rule of nines – pre-hospital for estimate
- Lund and Browder chart – more precise

# This combo is BAD

I. Fluid shift
II. Edema formation
III. Evaporative water loss from the burn

= VI. Hypovolemia (burn shock)

LOSS OF PLASMA IS GREATEST IN THE FIRST 4-6 HOURS AFTER THE BURN INJURY

# FIRST AID

- First Goal is to STOP THE BURNING PROCESS!

I. Stop, drop and roll. Smother with blanket or douse with water. DO NOT RUN!
II. Disconnect the person from the source of electricity
III. Remove clothing and jewelry. Take off blanket used to smother fire
IV. Cool burns or scalds by immediate immersion of water for at least 20 min.
V. Irrigation of chemical burns should be for 1 hour.
VI. Do NOT use ice for cooling
VII. Avoid hypothermia, keep the person as warm as possible.

# How do we get to where we are going?
# STRATEGY

I. Assessment
   1. Primary and secondary assessment/resuscitation
   2. Focused assessment
      a) Subjective data collection
      b) Objective data collection
   3. Psychological/social/environmental factors
      a) Occupational risk factors
      b) Alterations in ability to perceive environmental threats
      c) Social risk factors
      d) Environmental risk factors
   4. Diagnostic procedures
      a) Laboratory studies
      b) Imaging studies
      c) Other

# STRATEGY: Assessment

- Primary:
  - Airway / C-spine
  - Breathing
  - Circulation
  - Disability
  - Expose / Environmental controls

# Airway

- Open airway?
- Singed facial or nose hairs?
- Soot in back of throat?
- Throat swollen or burned?

# C-spine

- Any trauma (fall or RTI)- concerning c-spine injury?
- IMMOBILIZE EARLY
- Remember ACLS!  Jaw thrust/chin lift or Head tilt appropriate?

# Breathing

- Chest rise and fall
- Retractions, Rate
- Circumferential cyanosis
- Breath sounds

# Circulation

- Shock and tissue perfusion
- Color of skin
- Blistering
- Depth of burn (degree)
- Capillary refill

# Disability / Neurological

- LOC?
- AVPU
  - Alert
  - Verbal
  - Pain
  - Unresponsive
- PERRLA
  - Pupils
  - Equal
  - Round
  - Reactive
  - Light
  - Accommodation
- GCS?
  - Glasgow
  - Coma
  - Scale
  - 0-15

# Expose / Environmental controls

- Stop the burning process
- Expose the patient
- Keep warm

# Secondary assessment

- Full set of vitals, Focused adjuncts, Facilitate family presence
- Give comfort measures
- History and Head-to-Toe Assessment
- Inspect posterior surfaces

# Focused assessment

- Subjective data :
  - HPI / Chief complaint
    - Mechanism
    - Pain
    - Length of time exposed to burn source
    - Time of occurrence
    - Body area and type
      - Environment
      - Electrical / Lightening
      - Chemical
    - LOC
    - Related injuries
    - CPR at scene
    - Efforts to relieve symptoms
      - Home remedies
      - Alternative therapies
      - Medications
        - » prescribed
        - » OTC

- Past medical history
  - Current preexisting disease or illness
  - Surgical procedures
  - Smoking history
  - Substance / alcohol abuse
  - LNMP
  - Suicidal behavior
  - Medications
    - Prescriptions
    - OTC/Herbal
    - Allergies
    - Immunization status

- Objective data collection
  - General appearance
    - LOC, behavior, affect
    - Vital signs
    - Odors
    - Gait
    - Hygiene
    - Level of distress or discomfort

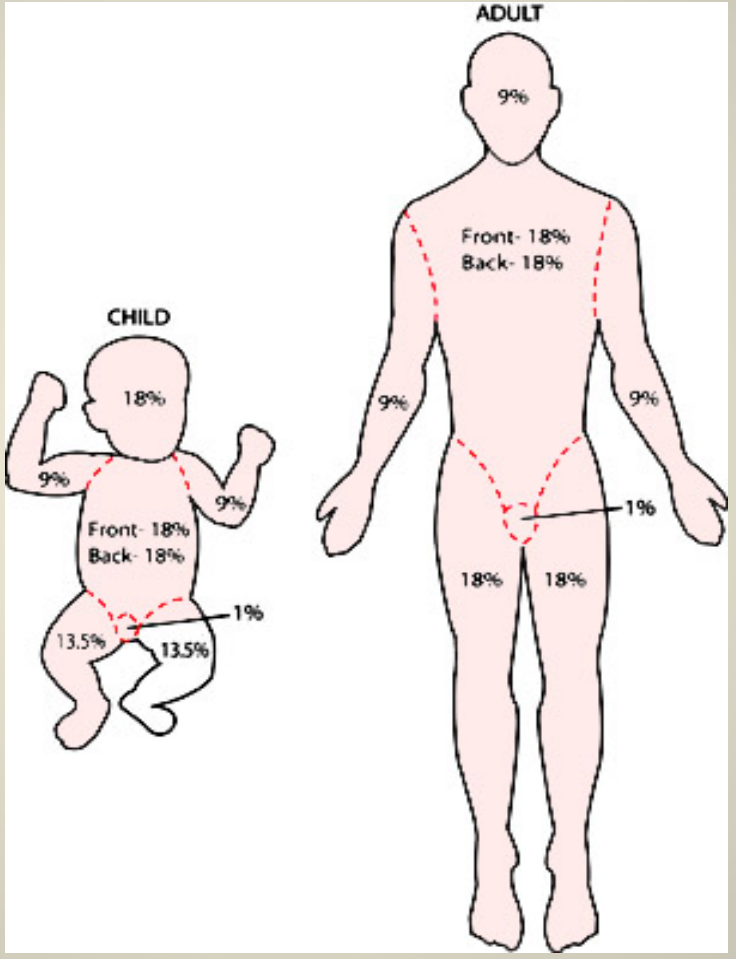
- Inspection
  - Airway: patent or not?
  - Burned tissues
    - Erythema of area
    - Red or mottled
    - Blister
    - Dark or leathery
    - Waxy or white

- Cardiac rhythm on monitor
- Sternal retractions
- Auscultation
- Palpation
  - Peripheral or central pulses
  - Deformities
  - Sensory perception surrounding burned tissue

# Rule of nines

| | |
|---|---|
| ❖ Head and neck | ❖9 |
| ❖ Whole arm | ❖9 |
| ❖ Whole arm | ❖9 |
| ❖ Posterior trunk | ❖18 |
| ❖ Anterior trunk | ❖18 |
| ❖ Whole leg | ❖18 |
| ❖ Whole leg | ❖18 |
| ❖Perineum | ❖18 |
| | ❖1 |

# Rule of 9's



# Assessment of burns

- Superficial burn  (1st degree)
- Superficial partial-thickness (2nd degree)
- Deep partial-thickness (2nd degree)
- Full-thickness (3rd degree)

# Superficial burn (1st degree)

- Only the epidermis
- Red and tender
- Mild discomfort some good over the counter (OTC) topical creams used. Aloe vera, Lidocaine

# First Degree Burn

## Only involves the EPI-dermis



http://www.berglundandjohnson.com/images/burn2.png

# Superficial partial-thickness burn (Superficial 2nd degree burn)

- Epidermis and part of the dermis
- Blistered, red, blanches with pressure
- Often seen with scalding injuries
- Sensitive to light touch or pinprick
- Treated on outpatient basis, heal time 1-3 weeks

# Second Degree Burn


http://www.burnsurgery.com/Modules/initial_mgmt/sec_5.htm

# Deep partial-thickness (Deep 2nd degree)

- Epidermis and most of the dermis
- Appears white or poor vascularized; may not blister
- Less sensitive to light touch than superficial form
- Extensive time to heal (3-4 weeks)
- Often require excision of the wound and skin grafting

# Deep partial– White is deeper than pink


http://www.emsworld.com/article/10320058/burning-issues

# Full-thickness (3rd degree)

- Epidermis, dermis and into subcutaneous tissue
- Dry, leathery and insensate. Typically no blistering
- Commonly seen when clothes are caught on fire or skin is directly exposed to flame
- Extensive healing time and need for skin grafting

# Third Degree Burn


http://www.burnsurgery.org/Modules/silver/images/section7case2/5.jpg

# Fourth degree

- Full-thickness extends to muscle or bone
- Commonly seen with high voltage electric injury or severe thermal burns
- Hospital admission, maybe surgical amputation of the affected extremity

# Fourth Degree
## Electrical burns go deep




http://www.sciencephoto.com/image/265754/530wm/M3350206-Third-degree_electrical_burns-SPL.jpg

# Assessment

- Psychological / social / environmental
  - Occupational (firefighters, electricians)
  - Alterations in perception (poor decision making, decreased sensation in OA)
  - Social risk (Child abuse? , Assault, Homeless, Depression?)
  - Environmental (cooking in enclosed area? contact with flame?)

# What needs to be done?

- Diagnostic procedures
  - Labs: CBC, Chemistries, HbCO, Type and crossmatch, Coags, UA, U preg, ABG, Serum and urine toxicology
  - Imaging: Chest x-ray, c-spine, CT, FAST,
  - Other: PL, ECG

# STRATEGY

- Analysis: Differential Nursing Diagnosis / Collaborative Problems
- Planning implementation
- Evaluation and ongoing monitoring
- Documentation or interventions and patient response
- Age-related considerations

# SRATEGY: ANALYSIS

- Analysis: Diagnoses and Problems
  - Risk for:
    - Ineffective airway clearance
    - Impaired gas exchange
    - Ineffective breathing pattern
    - Deficient fluid volume
    - Hypothermia
    - Infection
    - Ineffective tissue perfusion
      - Actual
    - Acute pain
    - Impaired skin integrity
    - Anxiety related to fear

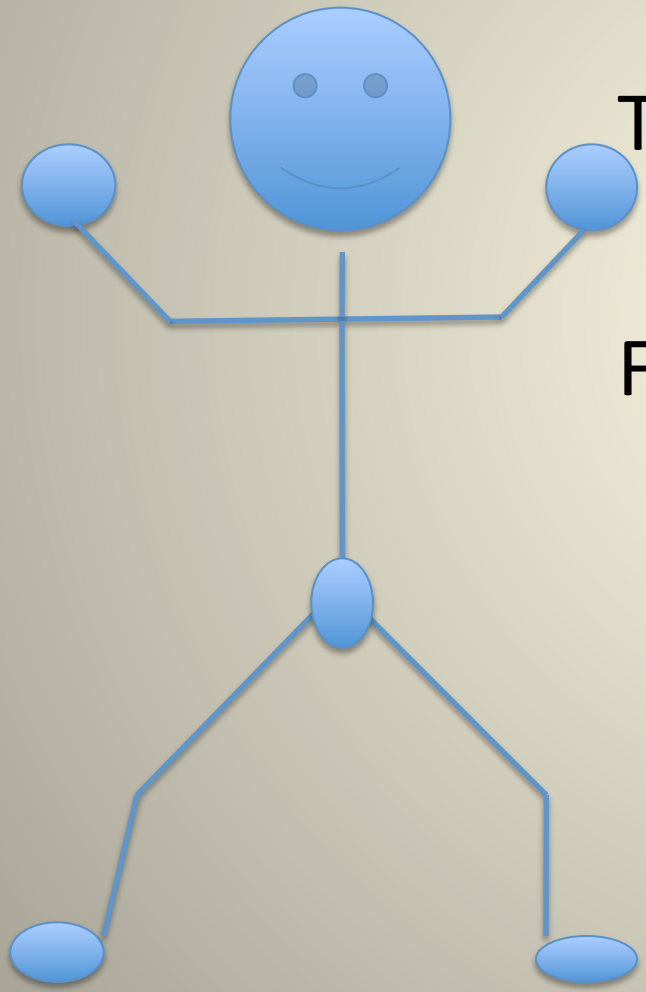
# STRATEGY : PLANNING IMPLEMENTATION/INTERVENTIONS

- Determine the priorities in care
- FLUID MANAGEMENT
- WOUND MANAGEMENT
- PAIN MANAGEMENT
- TETANUS

# Lund and Browder

| Area | Age 0 | 1 | 5 | 10 | 15 | Adult |
|---|---|---|---|---|---|---|
| A= ½ of head | 9 ½ | 8 ½ | 6 ½ | 5 ½ | 4 ½ | 3 ½ |
| B= ½ of one thigh | 2 ¾ | 3 ¼ | 4 | 4 ½ | 4 ½ | 4 ¾ |
| C= ½ of one leg | 2 ½ | 2 ½ | 2 ¾ | 3 | 3 ¼ | 3 ½ |

# Chart



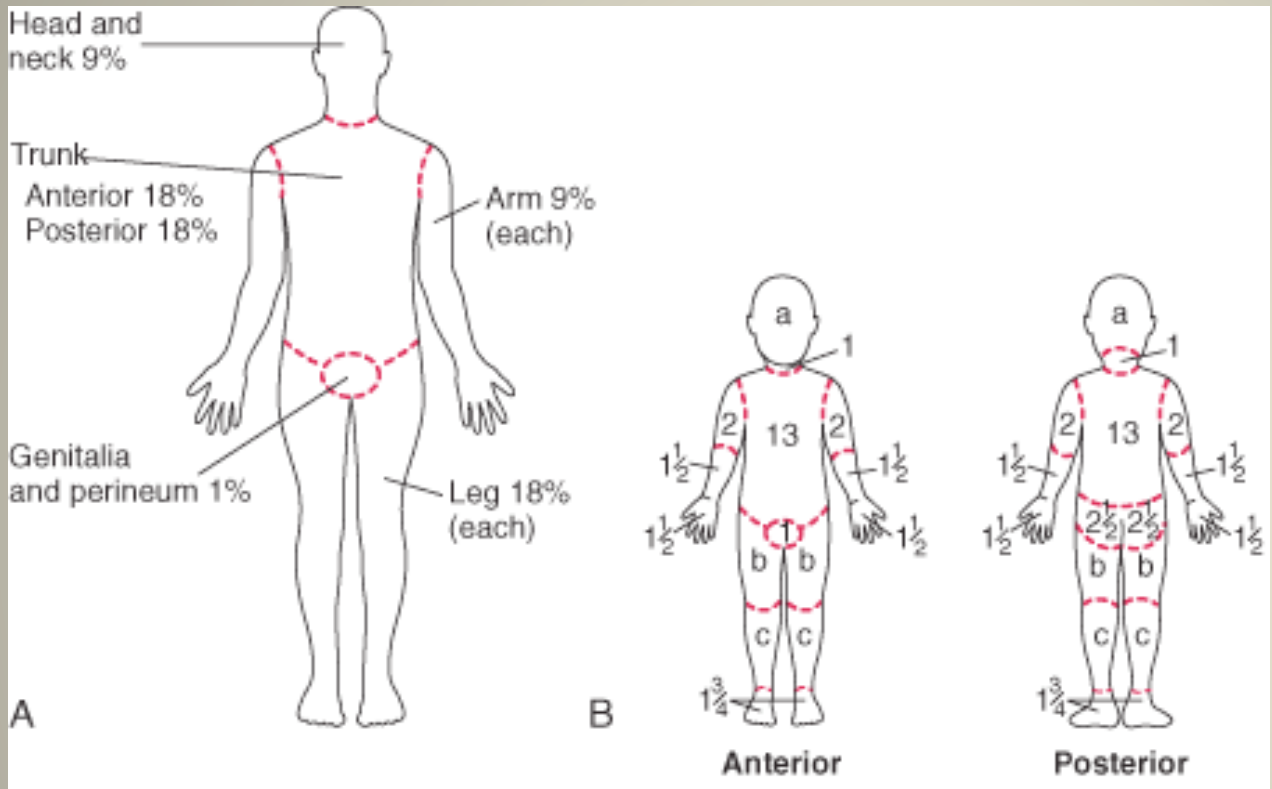
Head , Neck

Torso , Upper arm, Lower arm

Hands, Upper leg, Lower leg,

Feet and Genitals

# Lund and Browder




Relative percentage of body surface area (% BSA) affected by growth

| | Age | | | | |
|---|---|---|---|---|---|
| **Body Part** | **0 yr** | **1 yr** | **5 yr** | **10 yr** | **15 yr** |
| a = 1/2 of head | 9 1/2 | 8 1/2 | 6 1/2 | 5 1/2 | 4 1/2 |
| b = 1/2 of 1 thigh | 2 3/4 | 3 1/4 | 4 | 4 1/4 | 4 1/2 |
| c = 1/2 of 1 lower leg | 2 1/2 | 2 1/2 | 2 3/4 | 3 | 3 1/4 |


Artz CP, JA Moncrief: The Treatment of Burns, ed. 2. Accessed at: http://www.merckmanuals.com/professional/injuries_poisoning/burns/burns.html

See also: http://www.elroubyegypt.com/br/acute_burn_management.html

# Fluid management

- Remember that a formula is only an estimate and adjustments need to be made based on patient's status.
- **Fluid Resuscitation Protocol**
- Establish and maintain adequate circulation

↓

- Burns >20% TBS require initial fluid resuscitation

↓

- Use at least one large bore intravenous catheter. Begin Ringer's Lactate. Estimate initial rate according to the estimated percent of total body skin surface burned (%TBS). Estimated body weight (4cc/kg/%TBS burn in 24 hours giving half of the estimate in 1-8 hours.)

↓

- Maintain: Blood Pressure>90 systolic, Urine output 0.5-1.0ml/kg/hr, Pulse <130Temperature >37°C

↓

- Modify protocol in the presence of massive burns, inhalation injury, shock, and in elderly patients:- Fluid requirements are greater to prevent burn shock- Include colloid: either Hespan or Albumin in the patients from the beginning

↓

- **Transfer to Burn Center if a Major Burn is Present or a Moderate Burn depending on Local Resources**

http://www.burnsurgery.com/Modules/initial_mgmt/sec_3.htm

# Pain

- Control pain with narcotic analgesics
- Provide a dry sheet to protect nerve endings from air.

# Tetanus

- Is this immunization up to date?

# STRATEGY: EVALUATION

- Airway
- Breathing
- Circulation/Perfusion
- Pain
- Temperature
- Skin integrity

# Documentation

- All of your interventions and patient response
  - percent burn
  - pain
  - vitals
  - response to pain meds
  - wound description
  - dressing applied

# Specific burn injuries

- Age-related considerations
  - Pediatric and Geriatric
- Thermal and inhalation burns
  - Assessment
  - Analysis
  - Planning and implementation/interventions
  - Evaluation and on-going monitoring
- Chemical burns
  - Assessment
  - Analysis
  - Planning
  - Evaluation
- Electrical/Lightning burns
  - Assessment
  - Analysis
  - Planning
  - Evaluation

# Age-related concerns

- Pediatric burn patient
  a. *Growth or developmental related*
     1) Among the leading causes of death
     2) Smaller airways easily leads to obstruction by edema
     3) High ratio of TBSA to body mass increases heat exchange with the environment
     4) Lack of subcutaneous tissue & thin skin lead to increased heat loss and caloric expenditure
     5) Dependent on caregivers for direction
     6) Maltreatment possible
     7) Healing responses are more rapid

# Age-related concerns

*b. "Pearls"*

1) Curious about environment
2) Maltreatment: inflicted burns: both hands or both legs, brands/contact burns, cigarette and immersion burns
3) Hypothermia may render an injured child refractory to treatment.

# Age-related burns

- Geriatric burn patient
  a. *Aging related*
     1) Loss of subcutaneous tissue, thinning of the dermis
     2) Decreased touch receptors, pain receptors and slowing of reflexes
     3) Decreased skin growth delays wound healing and Vit D production
     4) Decreased airway clearance, decreased cough, and laryngeal reflexes
     5) Stiffening of elastin and connective tissue supporting the lungs
     6) Decreased alveolar surface area
     7) Decreased ciliary action
     8) Increased chest wall stiffness with declining strength in chest muscles

# Age-related concerns

*b. "Pearls"*

*1)* Altered mental status, dementia, dependant on caregivers

2) Slowing of reflexes and decreased sensation

3) Chronic illnesses decrease the reserve to withstand the multisystem stresses of a burn injury

# Thermal

- Causes: UV light or contact with flame, flash, steam or scalding

Most common type of burn.
Flash burns cause the most damage to the upper airway. Injuries tend to be limited to the supraglottic airways. Heat produces edema and can lead to obstruction of the airway.

# Thermal burns

Smoke inhalation can lead to the absorption of Carbon Monoxide. CO has a higher affinity to attach to red blood cells than oxygen. This leads to impaired delivery and/or utilization of oxygen. This eventually results in systemic tissue hypoxia and death.

Pulse oxygen monitor cannot differentiate between oxygen and CO. This further delays treatment of CO poisoning.

# Thermal burns

- Soot contains elemental carbon and can absorb toxins from burning materials that are toxic to the bronchial mucosa and alveoli because of the pH and the ability to form free radicals.
- These compounds can cause airway inflammation and multiple complications.

# Chemical burns

- Acids: Drain cleaners
- Alkali: Rust removers, swimming pool cleaners
- Organic compounds: Phenols and petroleum cleaners

# Chemical burn



http://www.burnsurgery.com/Betaweb/Modules/initial/bsinitialsec8.htm

# Chemical burns

- Denature protein within the the tissues or a desiccation of cells.
- Alkali products cause more tissue damage than acids.
- Dry substances should be wiped off first.
- Wet substances should be irrigated with copious amounts of water.
- All fluids used to flush should be collected and contained not placed into the general drainage system.
- Decontaminate patient: flush with warm water medially to laterally
- Protect yourself

# Alkali burns go deep



http://www.burnsurgery.com/Betaweb/Modules/initial/bsinitialsec8.htm

# Chemical burns

- The depth can be deceiving until the tissue begins to slough off days later.
- Because of this chemical burns should always be considered deep partial-thickness or full-thickness burns.

# Tar burn



http://www.burnsurgery.com/Modules/initial_mgmt/sec_6.htm

# Chemicals burns

- Is the pain our of proportion to the skin involvement? Consider hydrofluoric burns
  - Hydrofluoric acid burns are unique in several ways
    - Hydrofluoric (HF) acid, one of the strongest inorganic acids, is used mainly for industrial purposes (eg, glass etching, metal cleaning, electronics manufacturing). Hydrofluoric acid also may be found in home rust removers.
    - Dilute solutions deeply penetrate before dissociating, thus causing delayed injury and symptoms. Burns to the fingers and nail beds may leave the overlying nails intact, and pain may be severe with little surface abnormality.
    - The vast majority of cases involve only small areas of exposure, usually on the digits.
    - A unique feature of HF exposure is its ability to cause significant systemic toxicity due to fluoride poisoning.

http://emedicine.medscape.com/article/773304-overview

# Treatment of HF burns

- Immerse burn area for 2 hours in 0.2% iced aqueous tetracaine benzethonium chloride (Hyamine 1622) or iced aqueous benzalkonium chloride (Zephiran).
- Apply towels soaked with Zephiran and change every 2-4 minutes.
- Ice packs to relieve pain
- Obtain serum chemistries: hypocalcemia, hyperkalemia
- Insitiute cardiac monitoring: HF acid exposure can:
  - prolong QT interval
  - peak T waves
  - ventricular dysrhythmias

# HF treatment

- Calcium gluconate:
  - Apply 2.5% calcium gluconate gel to burn area
  - Subcutaneous infiltration: 0.5mL of 10% calcium gluconate/cm2 of burn, extending 0.5 cm beyond margin of involved tissue.
  - IV regional: Dilute 10-15 mL of 10% calcium gluconate in 5000 units heparin, then dilute in 40 mL dextrose 5% in water (D5W)

# Electrical

- AC- Alternating current- household current (more likely to induce fibrillation)
- DC- Direct current- car battery

- Path of least resistance:
  - electrical current will find the easiest way to travel through the body. Nerves tissue, muscle and blood vessels are easier to travel through than bone or fat.
  - nervous system is particularly sensitive. damage seen in the brain, spinal cord and myelin-producing cells.

# Electrical burns

# Lightning strikes

# Scenarios: example

- The patient was playing in the kitchen around the stove. The patient is a 4-year-old-male who was burned on the right leg, arm, and right side of the chest and abdomen. He was burned while running around the kitchen and boiling water fell onto him. It is an unintentional burn.

# Additional Source Information

for more information see: http://open.umich.edu/wiki/CitationPolicy

Slide 46, Image 1: Artz CP, JA Moncrief: The Treatment of Burns, ed. 2. Accessed at: http://www.merckmanuals.com/professional/injuries_poisoning/burns/burns.html

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Slide 71, Image 1: Pete Hunt, "Lightning", flickr, http://www.flickr.com/photos/hunty66/390350345/, CC: BY-NC 2.0, http://creativecommons.org/licenses/by-nc/2.0/.