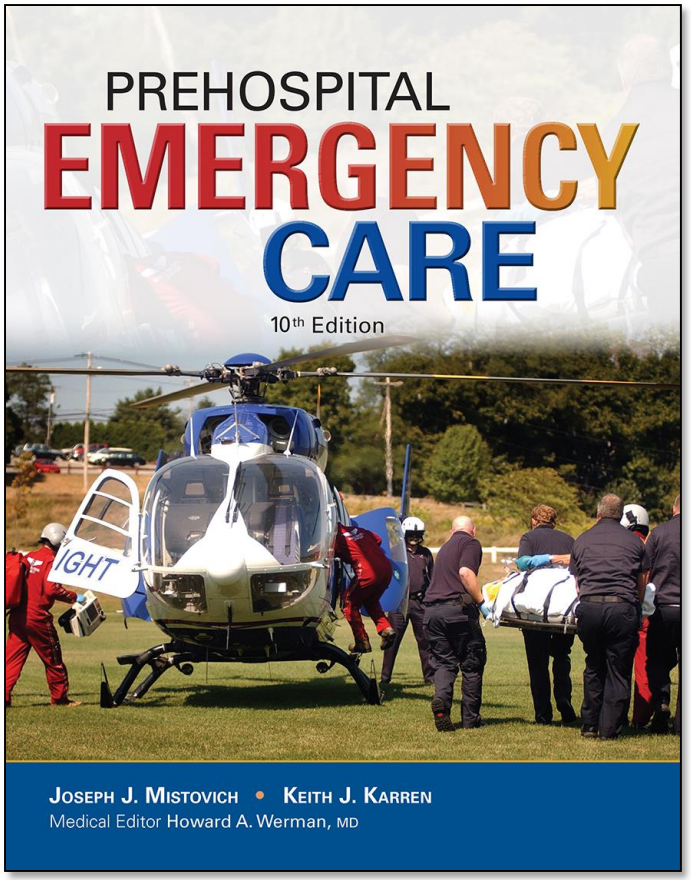
PREHOSPITAL EMERGENCY CARE

TENTH EDITION



CHAPTER 29

Burns

Learning Readiness

- EMS Education Standards, text p. 811

Learning Readiness Objectives

- Please refer to page 811 of your text to view the objectives for this chapter.

Learning Readiness Key Terms

- Please refer to page 811 of your text to view the key terms for this chapter.

Setting the Stage

- Overview of Lesson Topics
  - The Skin
  - Airway, Breathing, Circulation
  - Effects of Burns on Body Systems
  - Assessment and Care of Burns

Case Study Introduction

EMTs Ariana White and Bill Thornhill have responded for a 62-year-old woman who lit a cigarette in her car while receiving oxygen by nasal cannula. The patient is awake and sitting up, with burns of her face, neck, hands, and forearms. The patient's hair is singed, and she is coughing.

Case Study

- What are the priorities in managing this patient?
- What factors will help Ariana and Bill determine the severity of the patient's burns?

Introduction

- Burns affect multiple body systems, in addition to just affecting the skin.
- Body temperature regulation is a significant concern in burned patients.
- EMTs must have an understanding of types of burns and how they affect patients.

The Skin

- Layers of the skin
  - Epidermis
  - Dermis
  - Subcutaneous layer

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The Skin

- Functions of the skin
  - Provides a physical barrier against the external environment
  - Provides a barrier against infection
  - Provides protection from bacteria or other harmful agents
  - Insulates and protects underlying structures and body organs from injury

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The Skin

- Functions of the skin
  - Aids in the regulation of body temperature
  - Provides for sensation transmission (hot, cold, pain, and touch)
  - Aids in elimination of some of the body's wastes
  - Contains fluids necessary to functioning of other organs and systems

Airway, Breathing, Oxygenation, and Circulation

- Most burn patients who die in the prehospital setting die from an occluded airway, toxic inhalation, or other trauma.
- Maintain a patent airway, adequate ventilation and oxygenation, and control life-threatening bleeding.

Effects of Burns on Body Systems

- Circulatory system
  - Burn injuries can cause extreme fluid loss.
  - Burns increase capillary permeability, which decreases intravascular fluid.
  - Edema can further compromise tissue perfusion.

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Effects of Burns on Body Systems

- Circulatory system
  - Burn shock can develop after a few hours.
  - Vascular damage allows leakage of fluids and proteins from the vessels.
  - The fluid shift results in hypovolemia.

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Effects of Burns on Body Systems

- Respiratory system
  - Burns and inhalation of superheated air can cause obstruction of the airway.
  - Smoke and toxic gas inhalation can cause respiratory compromise and poisoning.
  - Circumferential chest burns can impair ventilation.

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Effects of Burns on Body Systems

- Renal system
  - Decreased blood flow to kidneys reduces urine output.
  - The kidneys must handle an increased amount of waste products from cell destruction.
  - Kidney failure may occur.

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Effects of Burns on Body Systems

- Nervous and musculoskeletal systems
  - Nerve endings can be destroyed.
  - Loss of function of extremities

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Effects of Burns on Body Systems

- Gastrointestinal system
  - Decreased GI perfusion can cause nausea and vomiting.
  - Longer-term considerations include ulcers and ensuring adequate nutritional support.

Assessment and Care

- Part of the assessment of burns includes assessing the depth of the burn.

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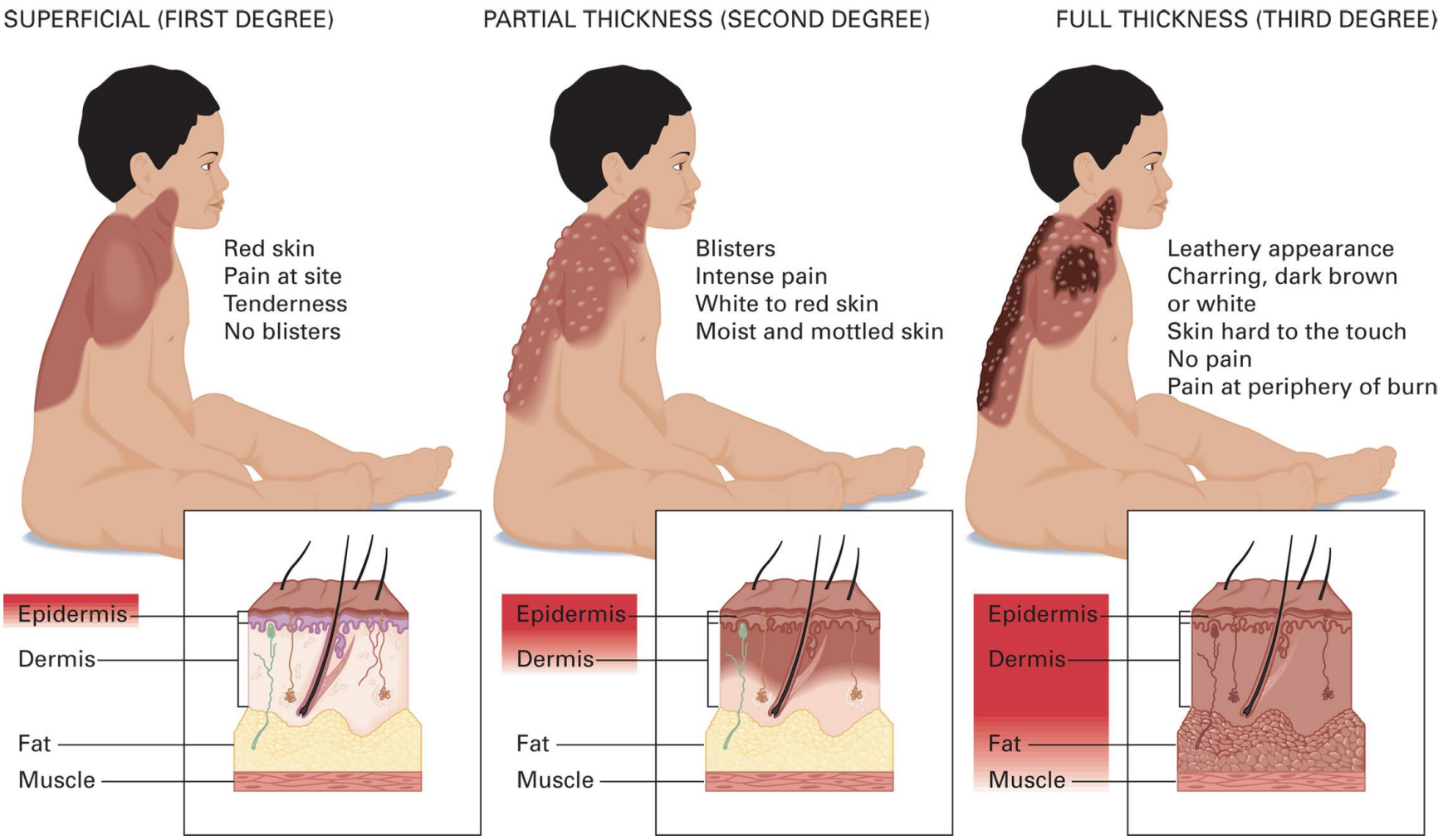
Classification of burns by depth.



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EMT SKILLS 29-1

Partial-Thickness Burns

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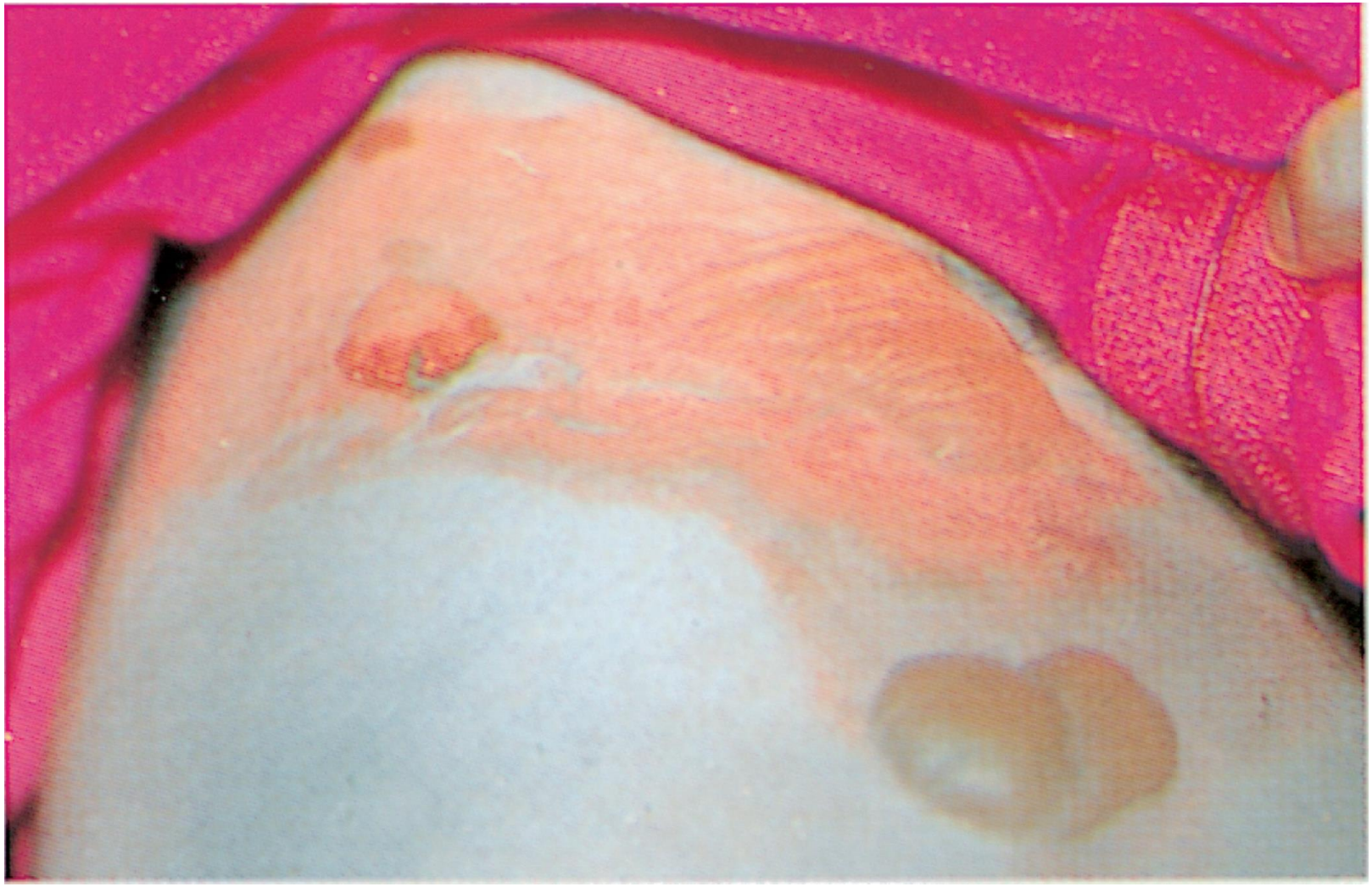
29-1C



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EMT SKILLS 29-2

Full-Thickness Burns

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29-2A

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29-2B

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29-2C

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29-2D

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Assessment and Care

- Burns are classified by severity to make transport decisions.
- Several factors are considered in determining burn severity.

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Assessment and Care

- Factors to consider include:
  - Depth of burn
  - Location of the burn
  - Patient's age
  - Pre-existing medical conditions
  - Percentage of body surface area involved

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Critical burns.

CRITICAL BURNS

- Full thickness burns involving hands, feet, face, eyes, ears, or genitalia.
- Burns associated with respiratory injury.
- Full-thickness burns covering more than 10% of body surface.
- Partial-thickness burns covering more than 25% of body surface in adults.
- Partial-thickness burns >20% in children less than 10 years and adults more than 50 years.
- Chemical burns or high-voltage electrical burns.
- Burns complicated by fractures or major trauma.
- Moderate burns in young children or elderly patients.
- Circumferential burns to any body part, such as arm, leg, or chest.

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TABLE 29-1 Determining Burn Severity Classification

	Adults	Children Under Age 5
Critical (severe) burns	• Any burn injury complicated by respiratory tract injuries or other accompanying major traumatic injury • Full- or partial-thickness burns involving the face, eyes, ears, hands, feet, genitalia, respiratory tract, or major joints • Any full-thickness burn injury covering 10% or more BSA • Any partial-thickness burn injury covering 25% or more BSA in adults younger than 50 years or 20% or more in adults older than 50 • Burn injuries complicated by a suspected fracture to an extremity • Any burn that encircles a body part (e.g., arm, leg, or chest) • Any burn classified as moderate in an adult younger than 55 is considered critical in an adult older than 55	As for adults plus: • Any full- or partial-thickness burn greater than 20% BSA • Any burn, including a superficial burn, involving hands, feet, face, eyes, ears, or genitalia • Any burn classified as moderate for an adult
Moderate burns	• Full-thickness burns with 2%–10% BSA excluding the face, hands, feet, genitalia, or respiratory tract • Partial-thickness burns with 15%–25% BSA involvement • Partial-thickness burns of 20% or more in adults younger than 50 years or 10% or more in adults older than 50	• Any partial-thickness burn of 10%–20% BSA
Minor burns	• Full-thickness burns involving less than 2% BSA • Partial-thickness burns less than 15% BSA • Superficial burns less than 50% BSA	• Any partial-thickness burn less than 10% BSA

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Burns to the face suggest respiratory tract involvement or injuries to the eyes.
(© Edward T. Dickinson, MD)

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Assessment and Care

- For smaller burns, the area of the patient's palm is approximately equal to 1% of the total body surface area.

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Assessment and Care

- Types of burns:
  - Thermal burns
  - Inhalation burns
  - Chemical burns
  - Electrical burns
  - Radiation burns

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Assessment and Care

- Mechanisms of burns
  - Flame burn
  - Contact burn
  - Scald
  - Steam burn
  - Gas burn
  - Electrical burn
  - Flash burn

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Assessment and Care

- Assessment-based approach
  - Scene size-up
  - Primary assessment
    - Remove the patient from the source of burning.
    - Within 10 minutes of the burn, cool the burn with water or saline.
    - Remove jewelry and smoldering clothing.

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Assessment and Care

- Assessment-based approach
  - Primary assessment
    - Assess the airway, breathing, oxygenation, and circulation.
    - Look for indications of airway burns and difficulty breathing.
    - If toxic inhalation is suspected, administer oxygen by nonrebreather mask.

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Assessment and Care

- Assessment-based approach
  - Primary assessment
    - Make a quick estimate of burn severity.
    - If the patient has signs of shock, look for a source of bleeding or other causes of shock beside the burns.
    - Establish priority for transport.

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Assessment and Care

- Assessment-based approach
  - Secondary assessment
    - Reassess the mechanism of injury and chief complaint.
    - Perform a physical exam.
    - Get a more accurate estimate of body surface area (BSA) involved.
    - Baseline vital signs

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Assessment and Care

- Assessment-based approach
  - Obtain answers to these questions:
    - How did the burn happen?
    - What caused the burn?
    - Was there an explosion or other mechanism of injury?
    - Did the patient lose consciousness?

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Assessment and Care

- Assessment-based approach
  - Obtain answers to these questions:
    - Was the patient in an enclosed space or did he inhale smoke?
    - How long ago was the patient burned?
    - What care was given by bystanders?
    - If the burn involved chemicals, what chemical?

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Assessment and Care

- Assessment-based approach
  - Obtain answers to these questions:
    - If the burn was a scald, how did it happen?
    - Is there a history of heart disease, lung problems, diabetes, or other serious conditions?

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Assessment and Care

- Signs and symptoms to look for:
  - Superficial burns
    - Pink or red, dry skin
    - Slight swelling
    - Pain and tenderness to touch

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Assessment and Care

- Signs and symptoms to look for:
  - Partial-thickness burns
    - White to cherry red skin
    - Moist and mottled skin
    - Blistering and intense pain

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Assessment and Care

- Signs and symptoms to look for:
  - Full-thickness burns
    - Dry, hard, tough, and leathery skin; may appear white and waxy to dark brown or black and charred
    - Inability to feel pain at the burned site
    - Pain around the edges of burns

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Assessment and Care

- Signs and symptoms to look for:
  - Inhalation injuries
    - Singed nasal hairs
    - Facial burns
    - Burned specks of carbon in the sputum

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Assessment and Care

- Signs and symptoms to look for:
  - Inhalation injuries
    - Sooty or smoky smell on the breath
    - Respiratory distress, restriction of chest wall movement, restlessness, chest tightness, stridor, wheezing, difficulty in swallowing, hoarseness, coughing, cyanosis
    - Burns of the oral mucosa

Click on the burn depth that is characterized by dry, tough, leathery skin, and an absence of pain to the immediate area.

A. Full-thickness

B. Superficial partial-thickness

C. Deep partial-thickness

D. Superficial thickness

Case Study

Bill and Ariana are concerned with the mechanism of the burn, since the patient was in an enclosed space, and the gas that ignited was in contact with her respiratory system. The patient is coughing, and has a history of medical problems requiring supplemental oxygen. In addition, they are concerned by the location of burns on the face.

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Case Study

They estimate the burns to be both superficial and partial thickness, and that they involve about 15% of her total body surface area.

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Case Study

- Would these burns be classified as minor, moderate, or severe? Support your answer.
- What criteria are present that would support transporting this patient to a burn center?

Assessment and Care

- Emergency medical care
  - Remove the patient from the source of the burn and stop the burning process.
    - Do not remove adherent materials from the burn.
    - Brush away dry powders before flushing with water.
    - Remove smoldering clothing.

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Stop the burning process.

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Remove the smoldering clothing.

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Assessment and Care

- Emergency medical care
  - Maintain an airway, adequate breathing, and oxygenation
    - Positive pressure ventilation for inadequate breathing
    - Administer oxygen by nonrebreather for toxic inhalation.
    - Maintain an SpO_2 of 94% or above

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Assessment and Care

- Emergency medical care
  - Classify the severity of the burn
    - Take into account BSA, source of the burn, location of the burn, patient age, and pre-existing medical conditions
    - Transport patients with critical burns immediately.

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Assessment and Care

- Emergency medical care
  - Cover the burned area with a dry, sterile dressing, burn sheet, or approved commercial dressing.
  - Moist dressings can lead to hypothermia.
  - Some systems allow a moist dressing for ≤10% BSA.
  - Follow protocol.

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Cover with dry, sterile dressings.

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Assessment and Care

- Emergency medical care
  - Keep the patient warm, treat other injuries.
  - Transport to the appropriate facility.

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TABLE 29-2 Burn Unit Referral Criteria

- Inhalation injury
- Partial-thickness burn of greater than 10% BSA
- Full-thickness burn
- Burns involving hands, feet, face, genitalia, perineum, or major joints
- Electrical burns
- Lightning strike injury
- Chemical burns
- Burns in patients with preexisting medical conditions or other trauma where the burn is the major injury

Source: American College of Surgeons Committee on Trauma.

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Assessment and Care

- Dressing burns
  - Avoid using material that leaves particles.
  - Never apply ointments, lotions, or antiseptics to burns.
  - Never break or drain blisters.

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Assessment and Care

- For burns of the hands and feet:
  - Remove jewelry.
  - Separate the digits with dry, sterile gauze.

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Separate burned toes with dry, sterile gauze.

(A)

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Separate burned fingers with dry, sterile gauze.

(B)

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Assessment and Care

- Burns of the eyes
  - Do not attempt to open the eyelids.
  - For thermal burns, apply dry, sterile dressings to both eyes.
  - For chemical burns, flush with water.

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Apply sterile gauze pads to both eyes.

continued on next slide

Assessment and Care

- Reassess
  - Every 5 minutes for unstable patients
  - Every 15 minutes for stable patients
  - Continually evaluate the airway

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Assessment and Care

- Chemical burns
  - The longer a chemical is in contact with the skin, the greater the potential for injury.

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Chemical burn to the face and ear. (© David Effron, MD, FACEP)

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Chemical burn to the hand. (© David Effron, MD, FACEP)

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Assessment and Care

- Chemical burns
  - Protect yourself first.
  - Brush away dry chemicals before flushing with water.
  - For most chemicals, flush with copious amounts of water.

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Lime powder should be brushed off the skin before flushing with water.

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Flushing a chemical burn to the eye.

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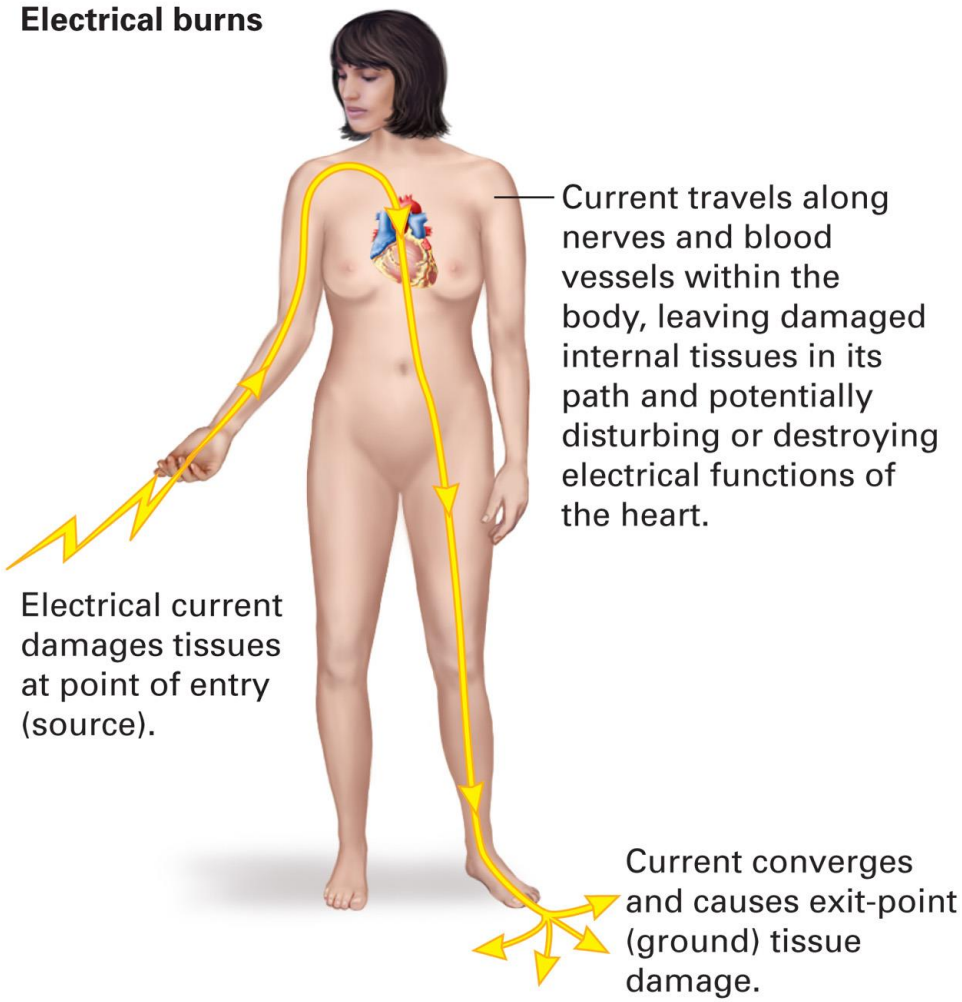
Look for two separate burns when electricity is the cause of injury.



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Assessment and Care

- Electrical burns
  - Damage is caused by heat; electrical impulses within the body can be disrupted.

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EMT SKILLS 29-3

Electrical Burns and Lightning Injuries

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Electrical burn, entrance and exit wounds. (© Edward T. Dickinson, MD)

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Electrical burn caused by chewing on an electrical cord.

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Burn associated with lightning injury.

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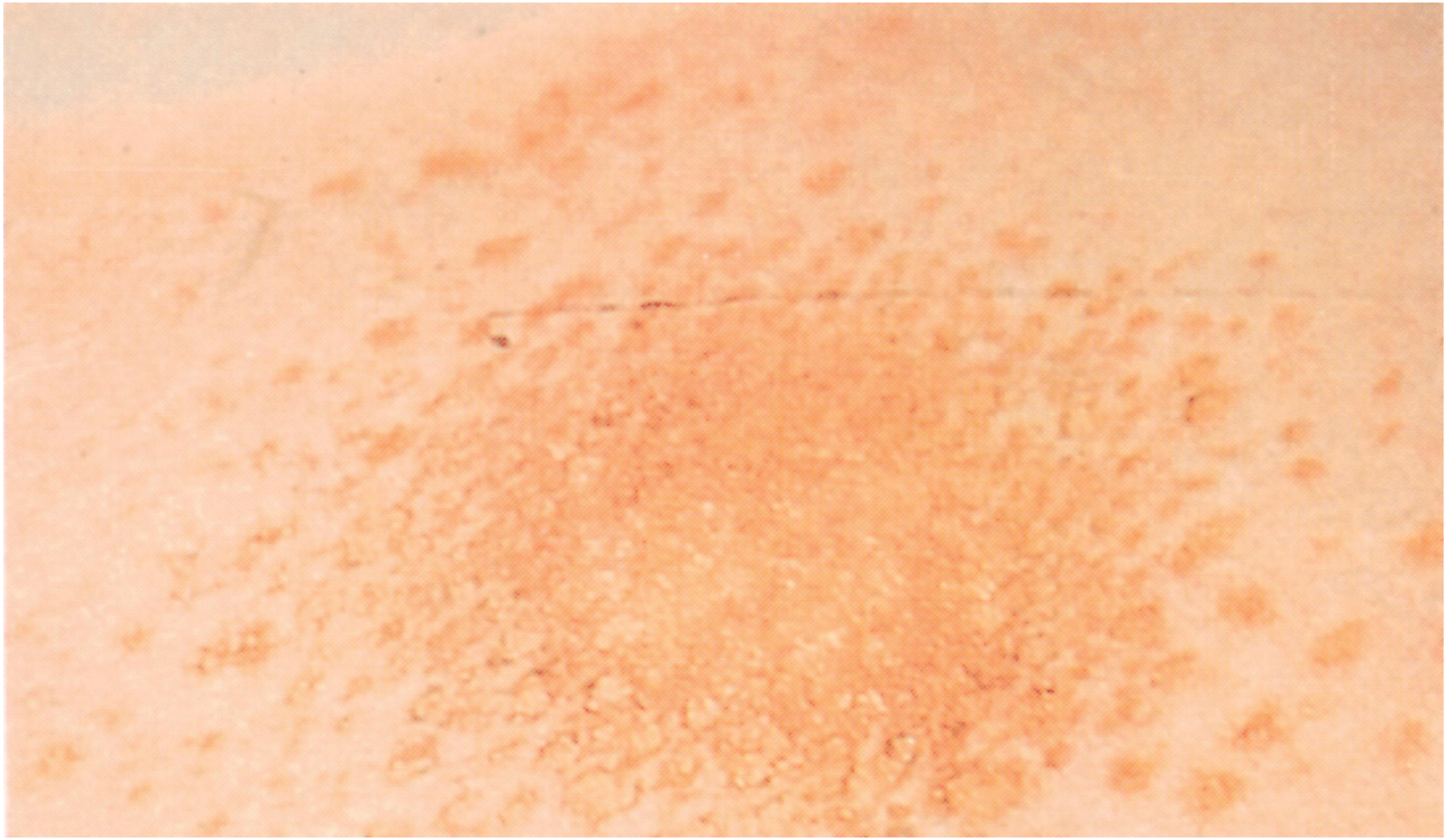
Abnormal skin pattern associated with lightning injury.



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Assessment and Care

- Electrical burns
  - Scene safety is crucial; always assume the power source is still active unless the power company has confirmed otherwise.
  - Do not attempt to remove the patient from the source, unless you are trained to do so.

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Assessment and Care

- Electrical burns
  - Do not touch a patient still in contact with the source.
  - Maintain an airway; provide positive pressure ventilation if respirations are inadequate.
  - Administer supplemental oxygen, if indicated.

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Assessment and Care

- Electrical burns
  - Be prepared for cardiac arrest.
  - Assess for muscle tenderness.
  - Assess for entrance and exit wounds.
  - Transport as soon as possible.

Assessment summary: burn emergency.

Assessment Summary

BURN EMERGENCY

The following findings may be associated with a burn emergency.

Scene Size-up

Pay particular attention to your own safety. Look for:
- Burning structures or material
- Chemicals
- Electrical sources
- Confined spaces
- Burned clothing
- Obvious burns to patient's body
- Evidence of explosion
- Other blunt or penetrating trauma

Primary Assessment

General Impression
- Stridor or crowing from upper airway
- Obvious burns to body and clothing
- Burns to neck and face
- Singed hair, nasal hair, eyebrows, and other facial hair
- Carbonaceous (black) sputum

Mental Status
- Alert to unresponsive

Airway
- Stridor (indicates upper airway burn)
- Edema to oral mucosa and tongue
- Burns around neck and face
- Black inside mouth

Breathing
- Normal to increased if airway or respiratory tract is not involved
- Increased or decreased, labored, and shallow if airway or respiratory tract burns

Circulation
- Increased; may be decreased if severely hypoxic
- Skin normal in unburned areas; may be cool, clammy, and pale

Status: Priority patient if large body surface area burns, airway or respiratory tract is involved, critical burns are apparent, or burns involve hands, feet, face, genitalia, or major joint locations

Secondary Assessment

Physical Exam

Head, neck, and face:
- Burns
- Singed hair, eyebrows, facial and nasal hair
- Dark black (carbonaceous) sputum
- Swelling of tongue and oral mucosa
- Hoarseness
- Coughing (may cough up black sputum)
- Cyanosis
- Stridor
- Burns to the oral mucosa

Chest:
- Burns
- Wheezing
- Circumferential burns around thorax may impede ventilation
- Blunt or penetrating trauma if explosion or fall involved

Abdomen:
- Burns
- Blunt or penetrating trauma if explosion or fall involved

Extremities:
- Burns (the appearance of the burn is largely determined by the burning mechanism, for example, thermal versus chemical)
- Circumferential burns may reduce distal circulation
- Swelling, pain, and discoloration if explosion or fall involved

Baseline Vital Signs
- BP: normal, may decrease with severe burns after a few hours (if BP decreased at the scene, look for evidence of other trauma)
- HR: normal or increased
- RR: normal; increased and labored if respiratory tract burn involved
- Skin: normal in unburned areas (if pale, cool, clammy immediately after burn may indicate shock from other trauma)
- Pupils: normal
- SpO_2: may be less than 94% if inhalation injury or toxic inhalation has occurred

History

Signs and symptoms of superficial burns:
- Skin that is pink or red, and dry
- Slight swelling
- Pain

Signs and symptoms of partial-thickness burns:
- Skin that is white to cherry red
- Moist and mottled
- Blisters
- Intense pain

Signs and symptoms of full-thickness burns:
- Skin that is dry, hard, tough, and leathery
- White and waxy, dark brown, or charred
- No pain in burned area
- Usually pain around the site of full-thickness burn

Signs and symptoms of inhalation injury:
- Facial burns
- Singed nasal and facial hair and eyebrows
- Black sputum
- Respiratory distress with labored breathing
- Coughing, hoarseness, cyanosis, stridor

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Emergency care protocol: burn emergency.

Emergency Care Protocol

BURN EMERGENCY

1. Remove the patient from the source of burn and stop the burning process.
2. Establish manual in-line stabilization if spinal injury is suspected.
3. Establish and maintain an open airway; insert a nasopharyngeal or oropharyngeal airway if the patient is unresponsive and has no gag or cough reflex.
4. Suction secretions as necessary.
5. If breathing is inadequate, provide positive pressure ventilation with supplemental oxygen at a minimum rate of 10–12 ventilations/minute for an adult and 12–20 ventilations/minute for an infant or child.
6. If breathing is adequate, administer oxygen by nonrebreather mask at 15 lpm if inhalation of a toxic gas or upper airway burn is suspected. If the burn is isolated to an area of the body and does not involve the face or a possible inhalation injury or toxic exposure, base your oxygen administration on the SpO_2 reading and signs of hypoxia. Administer oxygen to maintain the SpO_2 at 95% or greater.
7. Estimate body surface area burn (percent BSA) using the rule of nines.
8. Determine depth of burn: superficial, partial thickness, or full thickness.
9. Apply sterile dressings and bandages or a burn sheet.
10. If the burn is less than 10 percent BSA, dress wet per protocol. Dress all other burns dry.
11. Maintain body temperature.
12. Manage other associated injuries as appropriate.
13. If spinal injury is suspected, immobilize the patient to a backboard.
14. Manage specific burns as follows:
    Dry chemical burn:
    Remove affected clothing, brush off dry chemical, then irrigate with large amounts of water.
    Liquid chemical burn:
    Remove affected clothing; irrigate with large amounts of water if the chemical is one that does not react to water.
    Burns to the hands and feet:
    Remove all rings and jewelry; dress between digits.
    Chemical burns to the eyes:
    Flush with large amounts of water and continue to flush en route.
    Thermal burns to the eyes:
    Do not attempt to open eyelids; apply dry, sterile dressing to both eyes.
    Electrical burns:
    Carefully monitor pulse and respiration; inspect for entrance and exit wounds; assess for muscle tenderness; apply AED if patient is in cardiac arrest.
15. Transport.
16. Perform a reassessment every 5 minutes if unstable and every 15 minutes if stable.

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Case Study Conclusion

Bill cools the patient's burns with sterile water as Ariana completes a primary assessment, and places the patient on oxygen to maintain her SpO_2 above 94%. She then completes a rapid secondary assessment.

The patient is alert and complaining of pain. She has some hoarseness and a continuing cough. There are scattered rhonchi and wheezes in the lungs, but it is difficult to discern if they are related to the patient's COPD or the burns.

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Case Study Conclusion

The EMTs are concerned with the possibility of airway burns, so they begin transport without further delay. Medical direction advises transport to the closest burn center, about 35 miles away, with a request for ALS intercept.

En route, they dress the burns with dry, sterile dressings, and continually assess the airway, repeating vital signs every 5 minutes.

Lesson Summary

- Burns can be dramatic, and also can be associated with other life-threatening complications and injuries .
- Focus on life-threats first, then assess and manage burns.
- Inhalation burns are of particular concerns.

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Lesson Summary

- Manage the airway, provide ventilatory support as needed, and maintain oxygenation.
- Transport patients with critical burns to a burn center, if possible.