Pediatric Wound Management, Principles of Wound Healing and Pediatric Minor Burn Care in the Outpatient Setting

Maria Lutes, ARNP, PNP, CWON
Abbey Schneidmiller, ARNP, PNP, CWON

Speaker Introductions

• Maria Lutes is board certified in pediatric nursing and wound and ostomy care. She helps treat children with a range of conditions, from pediatric trauma to burns, non-healing wounds, pressure ulcers and pilonidal abscesses. After earning a masters of nursing at the University of Washington, she started her career as a surgical pediatric nurse practitioner at Mary Bridge Children's Hospital in Tacoma, Wash. Within her role as a surgical NP, she and her colleague, Abbey Schneidmiller, saw a need within their community for a designated pediatric wound clinic. As a result, they completed the Wound and Ostomy certification program at Emory University and opened the first designated pediatric wound clinic in Washington state in 2014. She has special interests in pediatric surgical disease processes, pediatric trauma, burn care, and wound management for pediatric anorectal malformations.

• Abbey Schneidmiller is a certified pediatric nurse practitioner and is certified in Wound and Ostomy care. She cares for children with a range of conditions, from pediatric surgical conditions, pediatric trauma, to pediatric wound and ostomy care. After earning a masters of nursing at the University of Washington, she started her career as a surgical nurse practitioner at Mary Bridge Children's Hospital in Tacoma, Wash. Within her role as a surgical nurse practitioner, she and her colleague, Maria Lutes, saw a need within their community for an outpatient pediatric wound and ostomy clinic. As a result, they completed the Wound and Ostomy certification program at Emory University and opened the first designated outpatient pediatric wound and ostomy clinic in Washington state in 2014. She has special interests in pediatric surgical disease process, pediatric trauma, burn and ostomy care and bowel management for pediatric anorectal malformations.

Disclosures

• No disclosures to report.

Learning Objectives

• Review anatomy and physiology of the skin.
• Define the various types of wounds and burns to include assessment (including % of burn and degree or burn) and management.
• Identify general concepts of wound healing and factors that impede healing.
• Discuss developmental and behavioral considerations when selecting wound management strategies.
• Review commonly used wound products and indications for use.
• Identify options for modifications in wound care to help minimize pain and anxiety all while promoting healing.

Case Study

History:

• 4 y/o male who presents with burn to left side of face, left shoulder and left chest s/p spilling hot chocolate 10 days prior. Was wearing shirt at time of injury which was promptly removed and burn was rinsed with cold water.

• Taken to ED, burns dressed with bacitracin and he was instructed to leave open to air. Follow up with PCP 3 days later, switched to silvadene and non-adherent gauze.

Physical Exam:

• Gen: awake, alert, NAD, well-hydrated
• Wound: mixed superficial and deep partial thickness burn (second degree)
• Measurements: 2cm L x 11cm W x 0.1cm D
• Wound base: 100% yellow slough
• Periwound: below is area of superficial partial thickness burn that is healing well with intact epithelium.

What would you do?

Structures and Function of the Skin

• The skin is one of the largest organ systems in our body.
  • It serves as a barrier and is dry, supple, and acidic.
  • Epidermis (outermost layer):
    • Approximately 20 cells thick
    • Major function is PROTECTION
    • Able to regenerate
  • Basement membrane zone:
    • Dermal-epidermal junction
    • Area affected by blister formation
  • Dermis:
    • Inner layer of skin, 2-4mm thick
    • Contains fibroblasts and macrophages
    • Made up of Collagen (strength) and Elastin (elasticity)
    • Most dermal structures capable of regeneration
Subcutaneous Tissue:
- Contains adipose tissue, connective tissue, blood vessels, lymphatics, and nerve endings
- Provides padding and even pressure distribution
- Critical to prevention of skin breakdown
- CANNOT regenerate

Fascia and Muscle:
- Well-vascularized
- Most vulnerable to effects of prolonged pressure, or ischemia
- This is where pressure ulcers generate
- CANNOT regenerate

Functions of the skin:
- Protection
- Heat regulation
- Sensory perception
- Excretion
- Synthesis of Vit D

Pediatric Considerations
- Neonatal skin with increased permeability
- Systemic absorption
- Damage
- Temperature regulation
- Infant skin thinner
- Epidermal stripping

Partial-Thickness (Superficial Lesions)
- Involves epidermis and possibly partial loss of dermis.
- No real measurable depth, 1-2 mm in depth
- Superficial, painful, red raw base
- Damage begins at skin surface and progresses downward.
- Caused by trauma NOT ischemia.
- “Top Down” injury
- Commonly seen with fragile or macerated skin.
- Examples: friction injuries, abrasions or road rash, skin tears, blisters, and burns

Moisture Associated Skin Damage
Incontinence Associated Dermatitis (IAD)
- Skin damage caused by prolonged or repetitive exposure to urine and/or stool.
- Begins with inflammatory changes (erythema and redness) and progresses to skin loss.
- Treatment:
  - Goal is to waterproof skin against urine and/or stool

Options for treatment
- Dimethicone
- Zinc
- Provides highest level of protection
- Apply thick
- Difficult to remove, use caution
- Crusting
- Stoma Powder and Copolymer film (Cavilon Spray)
- Cavilon is a waterproof film barrier
- Powder protects damaged skin
- Alternate powder/spray up to 3 layers
- Can couple with Zincskin

Full-Thickness Lesions
- Total loss of the epidermis and dermis.
- Extends into subcutaneous tissue; may extend to muscle or bone.
- Depth: 1+2mm
- Crater formation, undermining and tunneling are common
- +/- presence of necrotic tissue
- +/- elevated/edema
- Pathology:
  - Can be caused by trauma, abrasions, cast trauma, deep abrasions.
  - Also includes pressure and/or shear injuries over bony prominences.
  - Compression of vascularized tissues
  - These injuries are “bottom up”

Pressure Injuries:
- Localized injury to skin and/or underlying tissue, typically over a bony prominence
- Identify Risk Factors
  - Special needs population
  - Acute/chronic Illness
  - Incontinence
  - Trauma
  - Physical disabilities
  - Non-ambulatory
  - Non-Verbal
  - Sensation deficiencies
  - Medical devices
- Prevention
  - Activities of daily living
  - Appropriate supportive devices
  - Nutritional assessment
  - Plan/Family Education
  - Turning and repositioning schedule
- Treatment
  - Staging
  - National Pressure Ulcer Advisory Panel
  - Mixed wound healing principles
  - Prevention of further deterioration
**Thermal Injuries: Minor Burns**

- Most common mechanisms are from thermal injuries to include fire, scalding, and contact with hot objects.
- Scalding burns account for 90% of all burn related injuries in children.
- Many preadolescent-adolescent patients with injuries related to hot soup or macaroni and cheese.
- Many toddlers with injuries related to touching hot surface.

**Depth of Burns**

- Scalding burns account for 90% of all burn related injuries in children.
- Scalding burns are further categorized into:
  - Superficial: Extends into the papillary dermis.
  - Partial thickness: Extends further into the papillary dermis.
- Full-thickness burns that extend through entire epidermis and dermis into the subcutaneous tissue.
- Appearance: Thick, leathery eschar and charred.
- Often has a decrease in sensation.
- Most likely to develop burn scar contractures, even with skin grafting.

**Depth of burns: First Degree**

- Superficial injury limited to epidermis.
- i.e. sunburn
- Dry, red and painful
- Do not form blisters
- Typically skin “peels” within a few days to reveal new epidermis.

**Depth of burns: Second Degree**

- Partial thickness burns involve the epidermis and part of the dermis and are further categorized into:
  - Superficial: Extends into the papillary dermis.
  - Deep: Extends further into the papillary dermis.
- Full-thickness burns that extend through entire epidermis and dermis into the subcutaneous tissue.
- Appearance: Thick, leathery eschar and charred.
- Often has a decrease in sensation.
- Most likely to develop burn scar contractures, even with skin grafting.

**Depth of burns: Third Degree**

- Full-thickness burns that extend through entire epidermis and dermis into the subcutaneous tissue.
- Appearance: Thick, leathery eschar and charred.
- Although sometimes can appear red and mottled.
- Telerrale marker of full thickness burn:
  - DOES NOT BLANCHE
  - Often has a decrease in sensation.
- Most likely to develop burn scar contractures, even with skin grafting.

**Case Study – 4yo with Chest Burn**

- Treatment: Wound care initiated with Medihoney Gel and Xeroform. Secured with Kerlix and loosely wrapped Coban (as cover dressing). Parents instructed to change dressing daily (and child was allowed to bathe and/or shower daily to clean wound prior to new dressing application). After 5 weeks the wound healed. Family then instructed on scar care.

**Date of injury**: [Image of burn on a child]

**Day 7**: [Image of wound being dressed]

**Day 10**: [Image of wound being dressed]

**Day 18**: [Image of wound being dressed]

**Day 32**: [Image of wound being dressed]

**Day 51 – healed**: [Image of healed wound]
Factors That Affect Wound Healing

Perfusion/Oxygenation
- Every phase in healing requires oxygen!
- Requires adequate perfusion to deliver oxygen and other nutrients to the wound bed to allow for healing.
- Nutritional Status
  - Any patient with compromised nutritional intake is at risk for delayed healing, wound infection, or wound separation.
- Corticosteroids or other medications
  - Steroids prevent WBC activity in the wound.
  - Some thoughts that VA-A can be an antedote.
- Obesity
  - Impairs healing because adipose tissue is poorly perfused.
  - Also weight acts as a mechanical stressor.
- Diabetes
  - Elevated glucose levels interfere with wound healing and predispose the patient to infection.

How to Assess a Wound

What are the characteristics of the wound?
- Location
- Duration
- Dimensions and depth (in cm)
- Status of wound base
  - i.e. granulation tissue, yellow/grey, necrotic?
- Presence/absence of undermining or tunneling?
- Exudate
- Surrounding tissue
  - i.e. erythema, induration, maceration, etc.
- Systemic Factors
  - Fever, hypoglycemia
- Pain

Document this wound

Location: R upper lateral thigh
Dimensions: 14cmL x 8cmW x .1cm D
Wound Base: 75% adherent yellow/grey slough to the central portion of the wound; 25% islet cells
Tunneling: None
Undermining: None
Drainage: Yes, serous drainage present
Perimargins: Pink, dry, and warm
Document this wound

Location: R upper lateral thigh
Dimensions: 14cm L x 8cm W x 0cm D
Wound Base: 90% beefy red granulation tissue, 5% loosely adherent yellow slough, 5% new light pink epithelium
Tunneling: None
Undermining: None
Perimargins: Pink, dry and warm

Calculating Total Body Surface Area for Burns

Wallace Chart: Rule of Nine
Need to modify for infant/child due to large surface area of head and smaller surface area of lower extremities.
Rule of Palm
In estimating size of scattered burns, can use size of patient’s hand (including fingers).

Principles of Topical Therapy: How to Prepare the “Ideal” Wound Bed

Remove Impediments
• Debride necrotic tissue
• Identify and treat infection
• Absorb excess exudate
• “Wick” exudate from tunnels and undermined areas
• Open or excise closed wound edges
• Debride or drain blisters?
  • To do or not to do...it's always the question?
  • American Burn Association Recommends debridement if blister is > 2 cm.

Maintain Optimal Environment
• Maintain moist wound surface
• Protect wound from trauma and secondary infection
• Insulate wound bed

Guidelines for Dressing Selection

DEEP/WET
FILLER
• Alginates
• Foam (± AG component)
COVER DRESSING
• Gauze/Tape
• Silicone foam dressing

SHALLOW/WET
FILLER
• Alginates
• Foam
COVER DRESSING
• Gauze/Tape
• Silicone foam dressing

DEEP/DRY
FILLER
• Hydrogel dressing
• Manuka honey
COVER DRESSING
• Gauze/Tegaderm
• Silicone foam dressing

SHALLOW/DRY
FILLER
• Hydrocolloids
• Hydrogel
• Manuka honey
COVER DRESSING
• Transparent dressing
• Contact layer
Wound Care Products

**What You Can Use:**

- Focus on moist wound healing principles and atraumatic dressings.
- Vasoline gauze
- Xeroform gauze
- Antibiotic ointments
- Telfa
- Kerlix wrap
- Gauze
- Tape

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**Developmental Considerations and Pain Management**

- Choose wound care dressings which provide atraumatic removal.
- i.e. xeroform, silicone border dressings, alginate based
- Educate families on proper pain management.
- Alternating Tylenol and Ibuprofen.
- Oxycodone as needed 30 minutes prior to dressing change.
- Utilize child life if available at your facility.
- Distraction techniques
  - iPad, TV, Videos games, etc.
- Incentives such as a toy chest/box
  - Stickers, toys, coloring sheets, etc.

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**Case Study – 3m with IV Infiltrate**

**History:**

- 3m/o female recently hospitalized with Kawasaki’s disease and sustained an IV infiltrate. Discharged home on wound care of Medihoney Gel and Allevyn Gentle Border and changing q 3 days. She is afebrile and otherwise doing well.

**Physical Exam:**

- Gen: awake, alert, NAD, well-hydrated
- Wound: Full thickness
- Measurements: 2.5cm L x 1.2cm W x 0.1cm D
- Wound base: 100% adherent dry slough
- Periwound: PDW with new epithelium circumferentially around

**Treatment:**

- Initial visit transitioned to every other day wound care with Medihoney Alginate with Allevyn Gentle Border as cover dressing.
- Subsequent visit added Medihoney Gel to the Medihoney Alginate for additional moisture to wound bed.

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**Case Study Continued...**

Day 10

Day 21 - healed

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**What to do if the wound is a burn?**

- **Expose Skin**
  - Remove clothing over affected area.
  - For scald burns where source of burn may remain (thick soups or syrups) please rinse/remove.
  - Ok to run cool tap water over burned tissue.
- **NO ice,** as this can contribute to further tissue damage and hypothermia.
- Avoid items that can adhere to burn tissue causing further trauma to the tissue.
- Ok to apply moistened dressing (bacitracin and telfa, or moistened gauze).
  - Please NO silvadene as it is difficult to remove which makes assessment of the affected tissue difficult.

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### Assessment and Management of Burn

**What is the severity and TBSA?** If a child does not require transfer to a burn center, then recommend the following:

<table>
<thead>
<tr>
<th>Pain medications</th>
<th>Blisters</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Recommend alternating Acetaminophen and Ibuprofen RTC for first 2-3 days.</td>
<td>• Debridement remains controversial?</td>
</tr>
<tr>
<td>• Oxycodeone for breakthrough pain if necessary.</td>
<td>• ABA: Debride blisters &gt; 2cm</td>
</tr>
<tr>
<td><strong>Cleansing</strong></td>
<td>Tetanus:</td>
</tr>
<tr>
<td>• Soap or Chlorhexidine diluted with warm water or warm saline.</td>
<td>• Current if given within 5 years for patients with burns!</td>
</tr>
<tr>
<td>• Pre-medicate for optimal pain control.</td>
<td><strong>Tetanus</strong>:</td>
</tr>
<tr>
<td>• Maintain warm environment.</td>
<td>• Current if given within 5 years for patients with burns!</td>
</tr>
</tbody>
</table>

### Burn Care in the Outpatient Setting

**Pain medicsations**
- Acetaminophen
- Ibuprofen
- Oxycodeone

**Cleansing**
- Soap or Chlorhexidine

**Blisters**
- Debridement
- ABA: Debride blisters > 2cm

**Tetanus**
- Current if given within 5 years for patients with burns!

**Burn Care in the Outpatient Setting**

**At home wound care**
- Rx for pain medications, please advise family to have patient take pain medications 30min prior to dressing changes.
- Dressing should be changed 1-2x/day and prn saturation. Offer education for dressing changes and where families can obtain the dressing supplies.
- Please NO silvadene.
- No routine systemic ABX required (unless infection is suspected).
- Encourage movement and elevation (if appropriate) of affected burned region.
- Refer to local wound clinic if necessary and available in your area.

**Burn Dressings**
- Bacitracin and xeroform or telfa combination
- Maintains moist wound environment and allows for atraumatic dressing removal.
- Cover loosely with kerlix wrap gauze.
- Allow for swelling
- Allow for movement
- Can further secure with band-net or loosely applied coban.

**Post Healing Scar Care**
- Hydrating emollient
- Aquaphor
- Eucerin
- Scar massage
- Scar care products
- Mederma
- Vitamin E
- Coconut oil
- Silicone Gel

**Sun exposure**
- Broad Spectrum Sunscreen

### ABA Transfer Criteria

- Partial thickness burns > 10% TBSA
- Burns that involve the face, hands, feet, genitalia, perineum, and cross major joint lines
- Third degree burns
- Electrical burns
- Chemical burns
- Documental inhalation injury
- Burn injury with preexisting medical comorbidities
- Any patient with burns and associated trauma

**Case Study – 9yo Pressure Ulcer**

**History:**
- 9yo female who suffered a left tibia fracture while roller skating. She was seen at a local ED where a long leg splint was placed. During the time of splint placement, the child had some heel pain. She was seen by Orthopedics 11 days later when the splint was removed, she was noted to have a left heel pressure ulcer. She was then referred to the wound clinic.

**Physical Exam:**
- Gen: awake, alert, NAD, no pain
- Wound: Unstageable Pressure Ulcer
- Measurements: 1.5cm L x 2cm W x Unknown
- Wound base: 100% eschar
- Periwound: Poultice
Case Study Continued...

Treatment
- Medihoney with calcium alginate initiated with an Allevyn as a cover dressing to offer autolytic debridement of the eschar. This was used for 2 weeks until the eschar was debrided.
- Wound care was then transitioned to Hydrofera blue, to be changed every other day with Allevyn as a cover dressing. Final wound healing noted at 7 weeks, just as she was transitioning out of a walking boot.