JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

Burn Clinical Pathway

Trauma-Burn Clinical Pathway

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Updated: June 2021

Burn Clinical Pathway

Rationale:

This clinical pathway was developed by a consensus group of JHACH physicians, advance practice providers, and nurses to standardize the management of children with burn injuries and achieve the best possible outcome. It addresses the following clinical questions or problems:

- 1. When to activate a trauma team activation for a burn patient?
- 2. How to diagnose and classify burns?
- 3. How to treat burns?
- 4. When to consider transfer to a Burn Center for definitive treatment?

Background

Burns are the 3rd leading cause of injury deaths for children aged 5-9 years and the 5th for ages 1-4 years in the United States. Roughly 25% of all burn injuries occur in children under the age of 15 years. This practice guideline will outline the essential elements of evaluation and management of burns, to include the criteria of transferring patients to a burn center.

Diagnosis

Primary Assessment should include consideration for mechanism of injury (MOI) and other trauma and control of life threats. These may include, but are not limited to, inhalation injury, hypovolemia, hypoglycemia, and hypothermia.

After primary assessment and control of any life-threatening injuries, it is imperative to distinguish the depth of burn injury. Cutaneous burns are classified according to depth of tissue injury: Superficial (1st degree), Superficial-Partial Thickness (2nd degree), Deep Partial Thickness (2nd Degree), Full-thickness (3rd degree), Full-thickness-extension to deep tissues (4th degree).

A thorough estimation of burn size is essential to determine initial management, fluid resuscitation and consideration for transfer to a burn center. The extent of burns is expressed as the total percentage of body surface areas (TBSA). There are several methods to calculate TBSA.

Palm Method: Small or patchy burns can be approximated by using the surface area of the patient's palm. The palm of the patient's hand, excluding the fingers, is approximately 0.5 percent of total body surface area and the entire palmar surface including fingers is 1 percent in children and adults.

Lund-Browder. The most accurate method for estimating TBSA for both children and adults. See Appendix.

Burns are classified into four categories based on the burn source. This will affect the clinical management of the burn.

- a. Thermal
- b. Chemical
- c. Electrical
- d. Radiation

Clinical Management

Radiographic Studies:

- a. Consider CT imaging of the head if the patient has altered mental status or associated head trauma from a fall. Do not let this delay therapeutic intervention for Carbon Monoxide (CO) or Cyanide (CN) poisoning.
- b. Consider plain chest films for smoke inhalation
- c. Consider plain films if concern for concomitant trauma or foreign body/debris in wounds.

Lab recommendations: CBC, BUN, electrolytes, lactate, and coagulation profile when TBSA >20%.

Fluid Resuscitation: Formal fluid resuscitation using American Burn Association (ABA) Consensus Formula should be initiated for patients with partial thickness or worse burns covering 20% or more TBSA.

- a. 2-4 ml/kg/% TBSA Burn (using LR) in the 1st 24 hours
 - 1. Give ½ in the First 8 hours post burn
 - 2. Give ½ in the Next 16 hours post burn
 - a. Adults: 2 ml/kg/% TBSA
 - b. Children: 3ml/kg/% TBSA
 - c. Electrical: 4ml/kg/% TBSA
- b. Ringers lactated solution is fluid of choice for formal fluid resuscitation
- c. Avoid crystalloid boluses
- d. Place foley catheter in patients receiving formal fluid resuscitation and monitor urine output for a goal of 1cc/kg/hr in patients < 30 kg and 0.5cc/kg/hr in patients > 30 kg.
- e. If the patient is less than < 30kg, add maintenance fluids that include dextrose (D5LR or D5NS)

Pain Management

- a. Small burn injuries: acetaminophen and nonsteroidal anti-inflammatory drugs.
- b. Deeper burn: OTC analgesics in combination with opioids
 - 1) Intranasal fentanyl 1.5 mcg/kg
 - 2) Oxycodone 0.1 to 0.2 mcg/kg for patients <50 kg. 5 mg for patients > 50 kg.
 - 3) Referral to a burn center is needed when pain is too severe (or anticipated) to perform dressing changes and wound care without parental narcotics or conscious sedation.

Additional medications:

- a. Tetanus booster warranted if not received in last 12 months (deep superficial partial thickness)
- b. Antibiotics: Antibiotic for prophylaxis use is not routinely recommended.

Concerns for Non-accidental Burn Injuries:

- a. Does the injury match the reported history?
- b. Is the age of the burn consistent with the history?
 - 1) Most caregivers would reach out for burn care immediately. If there is a delay to care, is there a clear and adequate reason?
 - i. Does it appear as if a reasonable treatment plan has been implemented prior to your involvement if there was a delay?
- c. Is the pattern suggestive of an abusive injury?
 - 1) Cigarette burns and lighter burns⁵
 - 2) Submersion burns with sharp demarcations, sparing of skin folds/buttocks are concerning for forced submersion
 - 3) Clear patterns with curling iron, radiators/heaters, stoves, etc. concerning as contact with such surfaces should be transient and elicit immediate removal to neurologically normal child

American Burn Association Burn Center Referral Criteria: (May be telephone consultation to determine if patient transfer is warranted)

- a. Partial thickness burns >10% TBSA
- b. Burns that involve the face, hands, feet, genitalia, perineum, or major joints.
- c. Third degree burns
- d. Electric burns including lightning injury
- e. Chemical burns
- f. Inhalation Injury

Florida Trauma Burn Centers:

1. Tampa General Hospital:

(813) 844-7000

https://www.tgh.org/services/burn

2. Shands Health Care:

(352) 265-8000

https://ufhealth.org/uf-health-shands-burn-center

3. Jackson Memorial Hospital & Ryder Trauma Center:

(305) 243-6256

https://jacksonhealth.org/burn-center/#gref

Table 1: Recommendations of Treatment Based On Burn Type

General Considerations	 Remove clothing that is hot, burned, or exposed to chemicals/smoke. Remove jewelry that may become constricting. Observe for smoke inhalation in patients who have suffered thermal burns. There is NO role for topical steroids or antibiotics in the initial treatment of minor burns, as this may increase the risk of infection and impair healing. NO Silver sulfadiazine cream as it is cytotoxic and slows wound healing Wrap fingers and toes individually Maintain neutral to extended anatomical position with access to fingertips and toes for circulation to avoid contractures.
Circumferential Burns	 At risk for <u>Acute Compartment Syndrome</u> ACS may necessitate fasciotomy May require escharotomy if there is distal ischemia. Rarely required in the immediate aftermath of a burn. Consider trauma team activation Frequent assessment of extremity perfusion High risk finding for non-accidental trauma. Please see <u>JHACH Physical Child Abuse Clinical Pathway</u>
Chemical Burn with Powder	 Don personal protective equipment: gloves, non-permeable gown (trauma gowns) and mask with face shield. Remove all patient's clothing and jewelry Brush of all visible powder off skin using gloved hands Await EC or Trauma Team recommendations Consult Poison Control for assistance identifying chemicals and treatment recommendations. 1-800-222-1222
Suspected or reported electrical burns	 Consider EKG, cardiac enzymes, CK, and urinalysis to check for myoglobin due to rhabdomyolysis. Any patient in contact with a high voltage source should have continuous cardiac monitoring. Await recommendations for wound care.
Carbon Monoxide Poisoning	 For victims of house fires with carbon monoxide poisoning, oxygen saturation by pulse oximetry will often be normal or elevated and falsely reassuring relative to directly measure oxygen saturation. Treat the patient with high flow oxygen until carboxyhemoglobin levels drop to less than 10%.

Inhalation Injury	The leading injury in the upper airway is thermal injury: results in erythema, ulcerations and edema					
,,	Aggressive fluid administration to treat burn shock may promote early edema formation					
	 Increased production to thick secretions can cause distal airway obstruction, atelectasis, and impaired gas exchange 					
	 Tracheobronchial injury is usually caused by chemicals in smoke: symptoms include coughing and wheezing, soot containing airway secretions, increased work of breathing resulting in hypoventilation, erythema, and increased pulmonary shunting from lobar collapse or atelectasis May have normal chest radiograph Consider trauma team activation Remove all smoke covered clothing Frequent respiratory assessments May require intubation or tracheostomy. These could be difficult and the critical airway team should be utilized (Call 7-4300 and request surgical 					
	critical airway team)					
Patterned Burns	High risk finding for non-accidental trauma. Please <u>JHACH Physical Child Abuse Clinical Pathway</u>					
Burn-like Diseases	Diseases that mimic the appearance of burn-injuries and may vary in depth (e.g. superficial, partial thickness, or full thickness) Superficial					
	 Staphylococcal Scalded Skin Syndrome Toxic Epidermal Necrolysis Epidermolysis Bullosa 					
	Partial to Full Thickness					
	 Stevens-Johnson Syndrome Pemphigus Vulgaris Necrotizing Fasciitis 					

Table 2: Recommendations of Treatment and Wound Care Based On Burn Depth

Superficial (1 st Degree)	 Appearance: Minor Damage, Erythematous (Pink to Reddened Skin), painful, Dry, without blisters. Course: Heals without scarring in 3-5 days. Treatment: Moisturize for comfort, topical antimicrobial not needed for intact epidermis.
Partial Thickness Burns (2 nd Degree)	 Appearance: Partial destruction of dermis. Bright pink to cherry red skin with blisters. Skin moist, wet, very painful & edematous. Course: Heals in 7-10 days with minimal Treatment: 1. Do not aspirate or rupture intact blisters as increases risk of infection and causes pain. 2. Cleanse with normal saline (baby shampoo PRN). 3. Apply Mepilex Ag to the wound. Mepilex Ag should overlap the wound by at least 2 cm onto the surrounding skin. Apply the adherent side to the wound. Remove the film and mold the dressing in place-do not stretch. Hold the Mepilex Ag in place with dry gauze or wrap, secure with tubular. No tape to skin. Mepilex is left in place for 5 days. Change gauze only as needed.
Deep Partial Thickness (2 nd Degree)	 Appearance: Greater than 50% of dermis. Moderate eschar/ slough or ruptured blisters. Less painful because nerves are damaged (not complete anesthesia). Course: Heals in 2-3 weeks, severe scarring can occur, risk of skin scar contracture. May require skin grafting Treatment: Debride/remove eschar and necrotic skin, including ruptured blisters. Extensive debriding is rarely necessary and may be deferred until initial f/u visit. Cleanse wound with normal saline plus baby shampoo Apply Mepilex Ag to the wound. Mepilex Ag should overlap the wound by at least 2 cm onto the surrounding skin. Apply the adherent side to the wound. Remove the film and mold the dressing in place-do not stretch. Hold the Mepilex Ag in place with dry gauze or wrap, secure with tubular. No tape to skin. Mepilex is left in place for 5 days. Change gauze only as needed.
Full Thickness Burns (3 rd and 4 th degree)	 Appearance: Damage to all skin layers (3rd degree) and may involve fat, muscle, bone (4th degree). Skin is severely charred, waxy white, pale, leathery. No bleeding, painless (complete anesthesia). Course: High risk for infection and fluid loss Treatment: Immediate referral to burn center and/or Plastic Surgery consult.

Documentation Reminders

The following items should be documented within the medical record.

- a. History of Burn Injury
 - 1. When? Initial time of burn important if fluid resuscitation warranted
 - 2. How? Fire, steam, chemical, electrical, hot material
 - 3. Where? Enclosed space (inhalation injury)?
- b. Burn TBSA, type, and depth in the EPIC Burn Narrator utilizing the Lund-Browder method.
- c. Medical History: comorbidities (IDDM, immunosuppression)
- d. Medication History: steroid use, blood thinners, diabetic meds, etc.
- e. Allergies
- f. Last Tetanus: booster warranted if not received in last 12 months (deep superficial partial thickness)
- g. Wound Assessment
- h. Treatment performed
- i. Follow-up
- j. Referrals

Follow-Up Care

Patients with superficial or partial thickness burns, <10% TBSA, can be referred to the <u>JHACH</u> <u>Outpatient Wound Care Clinic (PAWS) (https://www.hopkinsallchildrens.org/Services/Wound-Clinic)</u>. Wound team can be consulted while the patient is in the emergency center for assistance in burn care. If wound team is unavailable, then the trauma team can be consulted if needed.

Other follow-up options:

- Blake Medical Center Outpatient Burn and Wound Reconstruction clinic (must be older than 1 year of age) (941) 567-2876
 - https://blakemedicalcenter.com/specialties/burn-care
- Tampa General Hospital Outpatient Hand and Burn Therapy Program
 (813)844-7706
 https://www.tgh.org/services/pediatrics/pediatrics-specialized-services/pediatric-burn-program

If blisters last for several weeks without resorption this indicate a possible underlying deep partial or full-thickness burn, necessitating referral to a burn center.

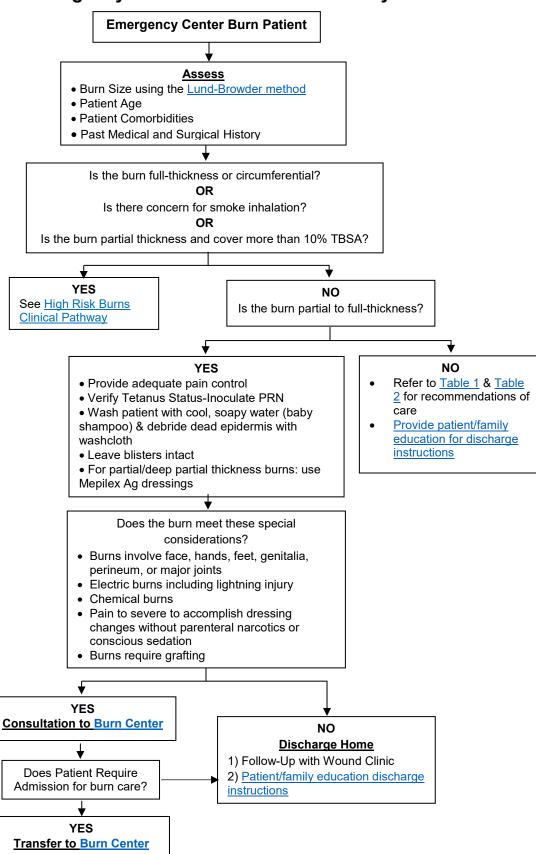
Follow-up care involves surveying for signs of infection, scarring, and contracture. Referral to Physical Therapy/ Occupational Therapy if patient presents with signs of skin scar contractures

Scarring and contracture can result in long-term disfigurement and disability

Patient/Family Education:

Discharge instructions are noted in Appendix 2

Emergency Center Burn Clinical Pathway



High Risk Burns Clinical Pathway

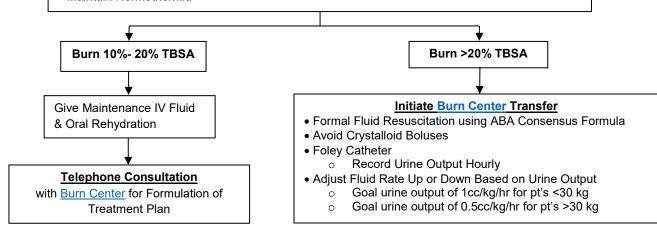
Patient's with High Risk Burns

- Partial to full-thickness burns >10% TBSA
- Partial to full-thickness circumferential burn
- Smoke Inhalation

Activate Trauma Alert

Establish need for IV Access

- Perform Primary and Secondary Trauma Survey
- Provide adequate pain control
- Verify Tetanus Status-Inoculate PRN
- Wash patient with cool, soapy water (baby shampoo) & debride dead epidermis with washcloth
- For partial/deep partial thickness burns: use Mepilex Ag dressings
- Wrap Patient in Dry Sheets
- Maintain Normothermia



Special Considerations and Additional Information:

Consider Intubation Prior to Transfer IF:

- Extensive Head, Neck, Facial Burns
- >40% TBSA Burn
- · Stridor, Wheezing, Hoarse Voice, Dyspnea
- CoHbg> 30% and Obtunded
- If Persistent Lactic Acidosis, Consider Cyanide Poisoning and Cyano Kit Use
- Extension 7-4300 Surgical Critical Airway Team

American Burn Association Criteria for injuries requiring referral to a Burn Center

- Partial thickness burns >10% TBSA
- Burns that involve face, hands, feet, genitalia, perineum, or major joints
- Third degree burns
- Electric burns including lightning injury
- **Chemical Burns**
- Inhalation Injury

Consider Escharotomy or Fasciotomy after Consult with Burn Surgeon:

- Full Thickness Circumferential Full Thickness Burns
 - AND
- Clinical Signs of Compartment Syndrome

OR

· Full Thickness Chest Burns with Restricted Respiratory Excursion

American Burn Association Consensus Formula

- 2-4 ml/kg/% TBSA Burn (using LR) in the 1st 24 hr
 - Give ½ in the First 8 Hrs Post Burn
 - Give 1/2 in the Next 16 Hrs Post Burn
- Adults: 2 ml/kg/% TBSA
- Children: 3ml/kg/% TBSA
- Electrical: 4ml/kg/% TBSA

In Adults:

· Adjust Fluid Rate for Goal UO 0.5kg/hr

- In Children: (<14 y/o): · Adjust Fluid Rate for Goal UO 1cc/kg/hr
- If Child < 30kg, Add Maintenance Fluids That Include Dextrose (D5LR or D5 NS) in addition to the consensus formula)

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- American Burn Association. Burn Injury Fact Sheet. Copyright 2018. https://ameriburn.org/wp-content/uploads/2017/12/nbaw-factsheet 121417-1.pdf (Accessed on February 26, 2020)
- 2. American Burn Association White Paper. Surgical management of the burn wound and use of skin substitutes. Copyright 2009. www.ameriburn.or (Accessed on January 04, 2010).
- 3. Edwards, C. (2020) Surface and Burn Trauma. In J. S. Blansfield, *Trauma Nursing Core Curse Provider Manual Eighth Edition* (pp 209-230). Emergency Nurses Association.
- 4. Griffin, B.R.; Frear, C.C.; Bable, F.; Oakley, E.; Kimble, R.M. (2019). Cool Running Water First Aid Decreases Skin Grafting Requirements in Pediatric Burns: A Cohort Study of Two Thousand Four Hundred Ninety-Five Children. *Annals of Emergency Medicine*, 75(1) 75-85. https://doi.org/10.1016/j.annemergmed.2019.06.28.
- 5. S Harel, B Burkey, AD Nanassy, M Marcolongo, E Phillips, C Campbell, M McColgan. Flame time of a cigarette lighter to achieve temperature capable of inflicting a burn. Sept 2017, *Burns*, 43(6): 1227-1232.
- 6. Western Trauma Association. Preferred Triage and Initial Management of the Burned Patient. Journal of Trauma and Acute Care Surgery. 87(5):1239-1243, November, 2019.

Outcome Measures:

- Emergency center length of stay
- Total number of burn patients seen annually
- Total number of burn patients transferred out annually
- Patient who meet trauma team activation criteria activated

Clinical Pathway Team Burns Clinical Pathway

Johns Hopkins All Children's Hospital

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Disclaimer

Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

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Appendix 1: Lund Browder Chart



□ Johns Hopkins BayviewBurn Center□ Johns Hopkins Hospital

Lund & Browder Chart (TBSA) Total Body Surface Area

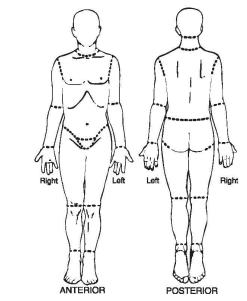
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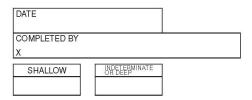
Addressograph



Children's Center

2-Hole 1/4 2 3/4 - 3-Hole 1/4 4 1/4





SHALLOW (PINK, PAINFUL, MOIST)

INDETERMINATE OR DEEP (DRY, LESS SENSATION, WHITE, MOTTLED, DARK RED, BROWN OR BLACK, LEATHERY.)

> Percent Surface Area Burned (Berkow Formula)

	AREA	1 YEAR	1-4 YEARS	5-9 YEARS	10-14 YEARS	Y 15 YEARS	ADULT	SHALLOW	INDETER- MINATE OR DEEP
İ	Head	19	17	13	11	9	7		
	Neck	2	2	2	2	2	2		
	Anterior Trunk	13	13	13	13	13	13		
Ī	Posterior Trunk	13	13	13	13	13	13		
Ì	Right Buttock	21/2	21/2	21/2	21/2	21/2	21/2		
Ī	Left Buttock	21/2	21/2	21/2	21/2	21/2	21/2		
Ī	Genitalia	1	1	1	1	1	1		
Ī	Right Upper Arm	4	4	4	4	4	4		
Ī	Left Upper Arm	4	4	4	4	4	4		
Ì	Right Lower Arm	3	3	3	3	3	3		
	Left Lower Arm	3	3	3	3	3	3		
Ī	Right Hand	21/2	21/2	21/2	21/2	21/2	21/2		
Ī	Left Hand	21/2	21/2	21/2	21/2	21/2	21/2		
	Right Thigh	51/2	61/2	8	81/2	9	91/2		
Ì	Left Thigh	51/2	61/2	8	81/2	9	91/2		
Ī	Right Leg	5	5	5½	6	61/2	7		
Ī	Left Leg	5	5	5½	6	61/2	7		
Ī	Right Foot	31/2	31/2	31/2	31/2	31/2	31/2		
	Left Foot	31/2	31/2	31/2	31/2	31/2	31/2		
	TOTAL								

Completed by Resident/Attending			
Print Name	Date	Time:	_

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Appendix 2: Burn Care Instructions

Burn Care Instructions – Pediatric

Why does my child need follow up care for his/her burns?

It is important to follow-up with your child's Burn Care Specialist or Primary Care Physician to make sure the burn is healing properly, to prevent scarring, and to help the skin return to its normal color as much as possible. This appointment may be needed within the first week of discharge. Review additional information on the After Visit Summary (AVS) for information on setting up an appointment.

When should I call a healthcare provider?

If you have questions or concerns about your child or if you notice any of the following symptoms, call your child's Burn Care Specialist or Primary Care Physician

- Redness or swelling of the burned area
- Increased pain **or** pain not relieved by pain medicines.
- Fever, rash, or bad smelling drainage from the burns. (Clear yellow drainage is normal.)

When should I give pain medicine?

First and second-degree burns can be very painful!

- It is better to prevent pain than to wait until your child is in pain to give medicine.
- The pain medication instructions will be included on your After Visit Summary discharge instructions.
- If your child is freely moving their burned body part, it is likely that their pain is controlled.
- Provide your child with pain medication 30 minutes prior to dressing changes and Follow-Up appointments.
- Encouraging your child to move the burned body part regularly is an important part of burn healing.

For all dressing types...

- Wash hands before and after any contact with burns or burn dressings.
- Keep supplies as clean as possible.
- Give pain medication 30 minutes prior to dressing change and/ or clinical visit.

Appendix 2: Burn Care Instructions (continued)

Silver impregnated foam dressing (Mepilex® Ag)

- Silver impregnated foam dressing sticks to the burn like a "Band-Aid" as it is healing.
- There is no need to change the silver impregnated foam layer it can stay in place for up to seven days!
- Keep the dressing dry and provide sponge baths.
- You only need to change the white outer gauze and stretch net dressing if it is completely wet with drainage; clear or yellowish drainage is normal.
- Additional supplies can be purchased at most pharmacies.
- We have provided you with one extra piece of silver impregnated foam dressing, just in case the current dressing falls off. If the silver impregnated foam dressing falls off:
 - 1. Wash the burn gently with mild soap and water pat dry
 - 2. Reapply a new piece of silver impregnated foam dressing
 - 3. Wrap with gauze
 - 4. Cover with stretch net dressing

Bacitracin and non-adherent mesh dressing

- Change the dressing daily during bath time.
- If the dressing is stuck on the burn, put your child in the bath with the dressing on, allowing the water to moisten the dressing and allow for easier removal.
- Apply antibiotic ointment to the non-adherent dressing and apply to the burn/wound.
- Wrap with gauze roll starting from the furthest part of the body (toes to hips, fingers to shoulders etc. and cover with stretch net dressing.

Hand burns

- After applying antibiotic ointment and non-adherent dressing, each finger should be wrapped separately in a straight position.
- First, wrap the gauze around the wrist to prevent from sliding off fingers.
- From the wrist, move the gauze up the back of the hand towards the tip of the finger.
- Wrap around the finger from the tip down to the palm overlapping half of each wrap.
- Wrap gauze around the wrist again before starting on the next finger. Continue wrapping each burned finger following the above steps.
- Do not stretch or pull hard on gauze. Wrapping should be fitted, but not constricting. Your child should be able to move their fingers easily with full range of motion.

Please refer to your child's After Visit Summary (AVS) for additional instructions