Nursing Care of the Patient with a Burn Injury

An Introductory Seminar in Burn Nursing for Student Nurses

Presented by the Burn Center at Crozer Chester Medical Center

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Nursing Care of the Patient with a Burn Injury: A Seminar for Student Nurses
Presented by the Burn Center at Crozer Health

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Learner Outcomes:

- Describe extent and depth of a burn injury
- Delineate the three phases of burn care
- Develop a nursing plan of care for a patient with a burn injury
- Discuss Outpatient management of a burn injury
- Describe new innovations in burn care

U.S. Fire and Burn Injury Estimates

- 486,000 Total burn injuries receiving medical care
- 29,165 Total Burn Center hospitalizations
- 3,275 Fire/Smoke Inhalation Deaths yearly
- Survival rate in Burn Treatment Centers: 97.7%

Source: American Burn Association 2023 Burn Injury summary Report

Demographics of Admissions to Burn Centers

Gender: 34% F; 66% M
Ethnicity: 59% White, 20% Black, 14% Hispanic, 7% other

Source: American Burn Association 2023 Burn Injury Summary Report

Burn

- Damage to the skin and underlying tissues
    - Heat (dry and moist)
    - Chemicals
    - Electricity
    - Lightning
    - Radiation

Source: American Burn Association Advanced Burn Life Support Provider Manual 2023

Mechanisms of Injury

- 40% fire / flame
- 32% scald
- 10% contact
- 3% electrical
- 3% chemical
- 9% other non-burn

- Fire - residential, bonfires, smoking, MVC, Smoking on HOT
- Scalds – hot liquids, bath / shower / kitchen
- Contact – curling iron, hot surfaces, appliances
- Steam
- MCI – bomb blasts
- Abuse / neglect

Source: American Burn Association 2023 Burn Injury Summary Report

Populations at Risk

- Toddlers / Children
- Young Adults - male / female
- Older Adults
- People with Special Needs

Phases of Burn Care

- Emergent/Resuscitative
- Acute
- Rehabilitative

Emergent/Resuscitative Phase

- First 48-72 hours post burn injury
- Goals:
    - Establish hemodynamic stability
    - Maintain tissue and organ perfusion

Initial Assessment and Management

Primary Survey

- The initial assessment of the burn patient is like that of any trauma patient.
- Assess for other traumatic injuries
    - Blunt
    - Penetrating
- Stop the burning process. Cool the burn.
- After the cooling process, the burn wound becomes the last priority.

Remember...
The ABC's of Burn Care

- ***A***irway maintenance with cervical spine protection
- ***B***reathing and ventilation
- ***C***irculation with hemorrhage control
- ***D***isability (assess Neurologic deficit)
- ***E***xposure & Environment
- ***F***oley and Fluids

Airway Maintenance with Cervical Spine Protection

- Must be assessed immediately
- Facial burns – anticipate swelling. Monitor closely.
- Consider endotracheal intubation
- ETT landmark – level of teeth / gums
- Cervical spine immobilization with associated trauma mechanism.

Breathing and Ventilation

- Assess chest excursions particularly in the presence of circumferential full thickness torso burns.
- Auscultate breath sounds. Verify breath sounds in both lungs.
- High flow oxygen at 15L (100%), utilize a non-rebreather mask.
- Nasogastric tube for stomach decompression if intubated
- Secure tubes

Circulation

- Monitor BP, heart rate, pulses
- Assess status of circumferentially burned extremities
- Doppler examination – circulation deficit in circumferentially burned extremity.
- Pulse oximetry probe – circulation check
- Initiate fluid resuscitation immediately TBSA ≥20%
- Establish IV access – 2 large bore IV's into unburned skin if possible.
    - Percutaneous
    - IO (intraosseous)
    - Central venous

Disability, Neurologic Deficit

- Assess for neurologic deficit
- Burn patients – usually alert & oriented initially.
- Altered LOC consider:
    - Carbon monoxide poisoning
    - Hypoxia
    - Associated injury
    - Substance abuse

    - Use AVPU method:
        - **A** – Alert
        - **V** – responds to Verbal stimuli
        - **P** – responds to Pain stimuli
        - **U** - Unresponsive

Exposure/ Environmental Control

- Remove all jewelry & constricting clothing.
- Cool burn with cool water or saline.
- NO ice.
- NO creams, butter or ointments.
- Cool, wet compresses appropriate only in small burns (< 10% BSA).

- Maintain core body temperature.
- Warm emergency transport vehicles; ED triage area, etc.
- Remove ALL wet soaks, coverings, etc. before transport. Cover with dry sheets & blankets to prevent hypothermia

Use Warming Devices

- Bair Hugger, or other Hypothermia unit
- Warm IV fluids.

Secondary Survey

Points to Consider

- History of the incident
  - Mechanism of injury
  - Location of victim
  - Presence of accelerants or contaminants
- Medical history
- Complete head to toe exam
- Tetanus prophylaxis
- Consider the potential for abuse

Stabilization in the Emergency Department

- Continuous reassessment
  - Secure airway
    - Mark ETT at level of teeth/ gums
  - IV access
- Monitor core temperature
  - Bair Hugger or other hypothermia unit
  - Warm IV fluids
- Pain/sedation medication
- Anxiolytics
- Gastric tube ≥ 20% TBSA & / or intubated
- Tetanus immunization
- No prophylactic antibiotics or steroids
- Foley catheter
  - Monitor & document hourly urine output
  - Adults: 0.5 ml/kg/hr or (30-50 ml/hr)
  - Children < 30 kg expect 1ml/kg/hr
  - Children > 30 kg expect 30-50 ml/hr
  - Accurate I & O
- Assessment of burn wounds
  - Wipe away soot prior to TBSA% calculation
  - Clean, disposable cloths with warm saline / Chlorhexidine

Baseline Diagnostic Studies

- CBC
- Hgb & Hct
- BMP (Basic Metabolic Panel) –
- Sodium, potassium, chloride, CO_2, glucose, BUN, creatinine, calcium
- CXR
- PT/PTT
- Platelets
- Urinalysis
- Microbiology – cultures ordered only if recent hospitalization or suspected infection
- Blood culture
- Urinalysis with reflex urine culture,
- sputum with gram stain
- wound with gram stain
- MRSA PCR (nasal)
- Altered LOC
- Toxicology screen
- EtOH
- Drug
- Covid test

Additional Tests in specialized circumstances

- Arterial blood gases (inhalation injury suspected)
- Carboxyhemoglobin (COHb)
- 12 lead ECG
- Suspected Cardiac event
- CPK with isoenzymes
- Troponin
- Serum creatinine kinase, troponin, & urine hemoglobin and myoglobin – electrical injury or prolonged downtime
- Spine & long bone X-rays with suspected concomitant injuries

Adjuncts to the Secondary Survey

- Universal Precautions
- Fluid Resuscitation
- Baseline vital signs
- Assess pulses & extremity perfusion
- Continued ventilatory assessment
- Pain Management
- Psychosocial assessment

Let's Discuss Management

- Inhalation Injury
- Fluid Resuscitation
- Wound Management

Inhalation Injury

- Hypoxia
- Carbon monoxide poisoning
- Injury above the glottis (heat)
- Injury below the glottis (combustible gases)

Carbon monoxide poisoning

- 200 X > affinity for Hgb than for oxygen

CO (%)	Symptoms
5-10	Mild Headache and Confusion
11-20	Severe HA, Flushing, Vision Changes
21-30	Disorientation, Nausea
31-40	Irritability, Dizziness, Vomiting
41-50	Tachypnea, Tachycardia
> 50	Coma, Seizures, Death

CO and Oximetry

- Pulse oximetry measures λ 660-940nm
- HgbCO and $HgbO_2$ absorb λ=660nm
- Therefore, pulse ox ??? O_2 or CO on Hgb
- Don't trust PULSE OX

Treatment

- Carbon Monoxide Poisoning
    - CO half life
        - 4 hours on room air
        - 1 hour breathing 100% oxygen

Patients with high carboxyhemoglobin levels should receive 100% O2 until levels are less than 10%.
Hyperbaric oxygen therapy may be indicated

Event History

- Where did injury occur?
- What was burning?
- Were noxious chemicals involved?
- Did patient lose consciousness?
- Describe patient assessment when rescued.

Physical findings

- Carbonaceous sputum
- Facial burns, singed nasal hairs, soot
- Agitation (hypoxia)
- Intercostal retractions
- Tachypnea
- Rales, rhonchi, diminished breath sounds
- Nasal or Oropharyngeal edema

Physical findings

- Agitation, anxiety, stupor, cyanosis, or other signs of hypoxia
- Hoarse voice, brassy cough, grunting, or guttural respiratory sounds
- Use of accessory muscles
- Inability to swallow

Treatment

- Maintain patent airway

- Consider intubation
    - # 8.0 mm oral endotracheal preferred
- 100% oxygen, non-rebreather mask
- Obtain ABG's, COHb levels
- Frequent suctioning
- Ventilator
- Fiberoptic bronchoscopy in the Burn Center

Injury Above the Glottis

- Majority of heat damage occurs above the glottis
- Resulting edema severe; may occlude airway
- Consider early intubation:
    - Assess for signs of respiratory distress

Injury Below the Glottis

- Usually chemical injury
    - Cyanokit
- Severity of injury???
    - Hx and exam may not be reliable
- Chest X-ray usually normal
- Improper fluid resuscitation
    - ↑ pulmonary edema

When to Intubate

- Follow ABLS/ATLS Protocol
- Indications
    - Airway obstruction imminent
    - Progressive hoarseness
    - Stridor
    - Level of consciousness GCS<8
    - NOT JUST BURNED FACE !!!

Burn Shock & Fluid Resuscitation

Goal – *maintain tissue & organ perfusion*
Avoid inadequate or excessive fluid therapy

Burn Shock – Pathophysiology
Distributive / Hypovolemic Shock
SIRS – cell mediators
Undamaged tissue releases fluid ➔
Vascular spaces ➔Interstitial spaces causing general dehydration
Hemolysis of RBC ➔ Hemoconcentration

Ringer's Lactate

- Na^+=130mEq/l
- Fluid leaving intravascular space is isotonic relative to plasma with similar pH and Na^+ and K^+

- Because most plasma protein leaves the vascular space and enters the interstitium protein concentration of edema ≈ plasma

Initial Fluid Rates -

prior to TBSA % calculation

- Prehospital and during primary in-hospital triage

- ≥20% TBSA - use the following initial LR fluid rates
  - 5 years old and younger: 125 ml per hour
  - 6 – 13 years old: 250 ml per hour
  - 14 years and older: 500 ml per hour (considered as adults)

Fluid Resuscitation

Adjusted Fluid Rates

- CONSENSUS FORMULA = 2-4 ml/kg/%BSA
  - Conjoined Brooke Army Institute- 2ml/kg/%BSA and
  - Parkland Formula 4ml/kg/%BSA
- ½ administered in the first 8 hours
- The remainder over the next 16 hours
- Electrical injury 4ml/kg/%BSA

Fluid Resuscitation

- Example:
- 24 y/o male, 70kg, 95% BSA
  - 2ml/kg/%BSA
  - 2 x 70 x 95 = 13,300ml
  - 4 x 70 x 95 = 26,600ml
  - 1st 8 hours = 6,650-13,300= 831-1,662ml/hr

Pediatric Resuscitation
Pediatric= 3ml/kg/%TBSA
Example: 26Kg 5y/o child
3ml/26kg/20% = 1,560ml
½ in first 8 hours = 780 ml
Adjusted rate 780ml/8=98ml/hr
Resuscitation
+
Maintenance (D5LR)
40ml for 1st 10kg
20ml for next 10kg
6ml for 6kg = maintenance rate of 66ml/hr
Consult Burn Center for direction

Caveats

- Vasopressors inappropriate
- Do NOT run fluids wide open for an extended period
- Follow fluid bolus with titration increase
- Sequelae of excessive fluid administration

Fluid Resuscitation

- Complications
    - Fluid Overload
- Abdominal Compartment Syndrome
- Extremity Compartment Syndrome

Edema Formation

Fluid needs immediately post burn

Calculation of fluids: The total volume of fluid calculated from this formula is an estimate of the patient's fluid needs during the first 24 hours, p***ost burn***.

Fluid Resuscitation Formula Example

2 ml LR / kg / % TBSA = Fluids over 1st 24h

- Administer ½ of the total volume over the first 8 hours post burn
- Administer ¼ of the total volume over the second 8 hours
- Administer ¼ of the total volume over the third 8 hours

35 yr old white male was involved in a steam explosion at work. The incident occurred at 1300 hours. He was admitted directly to the burn unit. Estimated BSA = 50% Wt. 70kg

- 2ml LR x 70 kg x 50% = _____ml in 1st 24 hrs.

Fluid Example 1st 8 hr.

- ½ of 7,000 ml = _____in first 8 hrs
- IV Rate in 1st 8 hrs. = _____ml/hr

Fluid Example 2nd 8 hr.

- ¼ of 24 hr. total in 2nd 8 hrs. = _____ml
- IV rate in 2nd 8 hrs. = _____ml/hr

Fluid Example 3rd 8 hr.

- ¼ of 24 hr. total in 2nd 8 hrs. = _____ml
- IV rate in 2nd 8 hrs. = _____ml/hr

Monitoring Resuscitation

- Hourly urine output
- Adults: 0.5 ml/kg/hr or (30-50 ml/hr)
- Children < 30 kg expect 1ml/kg/hr
- Children > 30 kg expect 30-50 ml/hr

Is more fluid needed?

- Inhalation injury
- Associated injuries
- Dehydration
- Electrical injury
- ETOH

Monitoring

- Management of oliguria
    - Increase resuscitation fluid
    - No fluid boluses
    - Avoid diuretics
- Management of Rhabdomyolysis
    - Increase fluids
    - Urine output 1.0-1.5 ml/kg/hr or (75-100 ml/hr)
- Assess changes from baseline vital signs
- Hypotension vs hypertension
- Bradycardia vs tachycardia
- Hgb / Hct concentrated
    - Do Not resuscitate with blood products, unless associated trauma present
- Electrolyte abnormalities
    - Hyperkalemia
    - Hypokalemia
    - Hypernatremia

Neurovascular Compromise

- Circumferential extremity burns
- Circumferential trunk burns
- Palpate pulses / Doppler checks
- Remove constricting clothing & jewelry

Principles of a Releasing Escharotomy

- Relieve respiratory distress
- Prevent circulatory occlusion

Escharotomy

- Typically performed on full thickness, circumferential extremity or torso burns
- Evaluate tissue pressures
- Should ideally be done in the Burn Center

Fasciotomy

- Incision of investing muscle fascia beneath burned tissue
- Rarely required – very deep burns
- Electrical injury

Skin: The Largest Organ in the Body

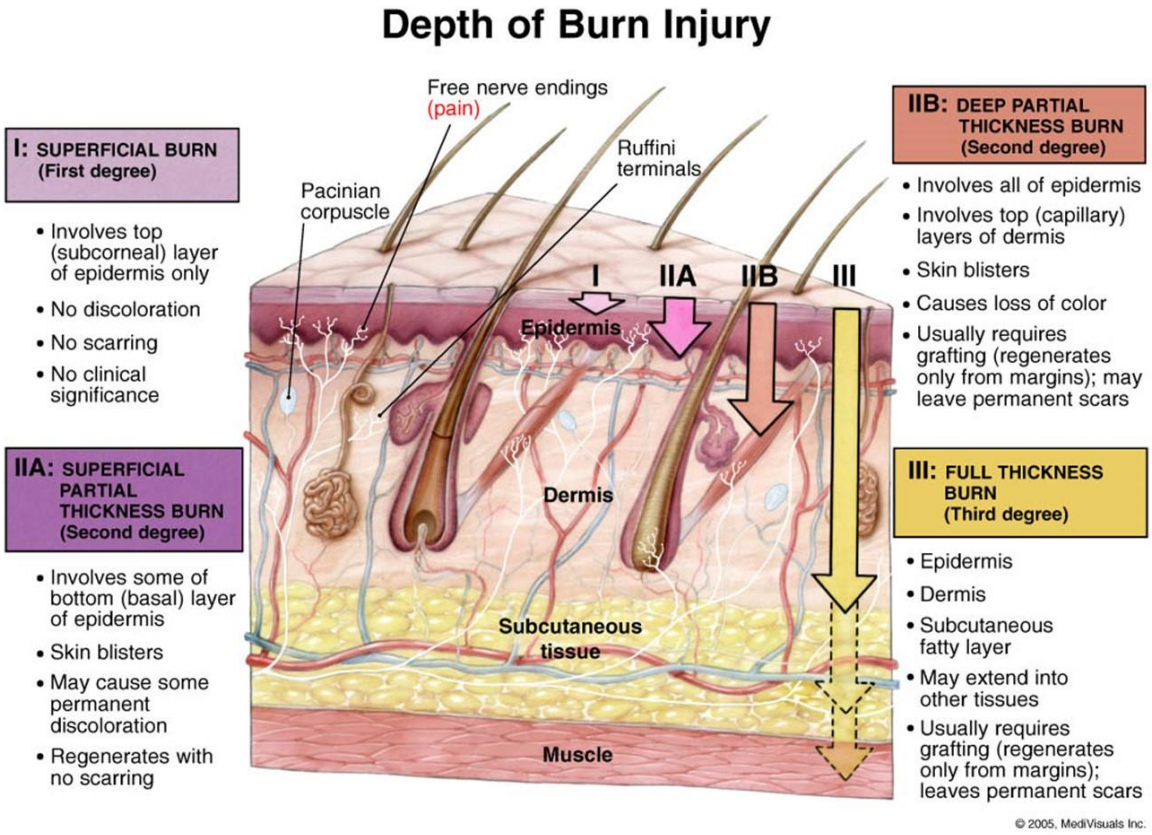
Functions of the Skin

- First line barrier against infection
- Conservation of body fluid
- Temperature regulation
- Organ of excretion
- Organ of secretion
- Sensation

- Identity
- Vitamin D production
- Appearance

Classification

- Degrees
  - First
  - Second
  - Third
  - Fourth
- Partial thickness vs. Full thickness
- Burns are *NOT* staged



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First Degree Burn
Superficial
Epidermis layer injured
Dry, no blisters, minimal or no edema
Erythematous
Very painful
Rapid heat loss
Healing: 2-5 days with no scars

May have some discoloration

Not included in the estimation of TBSA%
Typically, not admission criteria

Second Degree *Partial Thickness*
Healing
Superficial
5 – 21 days, no grafting
Deep Partial
21 – 35 days with no infection
If infected, may convert to full thickness injury

Moist blebs, blisters. Underlying tissue – mottled pink & white, cherry red, weeping wounds. Coagulated blood vessels visible in deep dermal 2nd degree injuries. Good capillary refill. Very painful. Rapid heat loss.

Third Degree *Full Thickness*
Complete destruction of epidermis. Dermis injury down to subcutaneous tissue. May include fascia, muscle and bone.

- Dull red dry leathery, eschar
- Mixed white, waxy, pearly, khaki, mahogany, soot stained
- Insensate. Less rapid heat loss

Healing: Large areas require grafting, which may require months. Small areas may heal from the edges after weeks.

Percent of BSA (Body Surface Area) *Methods to Calculate Percent of Burns*

- Rule of Nines
- Palmer Method
- Lund & Browder Chart

Palmer Method:
1% TBSA = size of the *patient's* palm and fingers

Lund and Browder Chart

Determining the Severity of a Burn

- Depth of Tissue Damage
- Percent of BSA (Body Surface Area) involved
- Past Medical History – pre-existing illness
- Accompanying Trauma
- Special Care Areas: hands, face, feet, perineum, major joints
- Age – mortality / morbidity
- Electrical and Chemical Burns
- Burns with Inhalation Injuries

Electrical Injury Etiology & Incidence

- 3% Burn Unit Admissions
- Sex
- Age
- Work related
- TBSA
- Seasonal Fatalities

True Electrical Injury

- Current passes directly through the body creating an entrance and exit wound

Contact Sites

Severity of Electrical Injury

- Factors that determine the extent of tissue damage and the complications:
    - Type of current
    - Amperage
    - Current pathway
    - Duration of contact
    - Resistance

Resistance of Electrical Energy

- Follows path of least resistance
- Varies according to tissue type:
    - Nerves (least resistance)
    - Blood vessels
    - Muscles Skin
    - Tendon
    - Fat
    - Bone (greatest resistance)

Electrical Arc Injury

- Current courses external to the body from the contact point to the ground

Body Conduction

- Low voltage < 1000 volts
    - Delayed onset migratory pains
    - Can cause fatal cardiac arrhythmias
- High voltage > 1000 volts
    - Heats tissues immediately
- May cause deep tissue necrosis

Immediate Care of Electrical Injury

- At the Scene:
    - Determine power source
    - Turn power off
    - Assess for cardiac / respiratory arrest
    - C-spine control

    - Assess LOC, other injuries, contact points (entrance - exit wounds)
    - Keep patient warm

Hospital Care of Electrical Injury

- Possible intubation
- Cardiac monitoring - 12 lead EKG
- C-spine control
- IV access
- Foley catheter - keep urine output > 75-100 ml/hr
- Labs, urine myoglobin
- Assess pulses - all extremities
- X-rays to assess C-spine and fractures
- Reassure patient & family

Findings Suggesting Electrical Injury

- Loss of consciousness
- Paralysis or mummified extremity
- Loss of peripheral pulse
- Contact injury

Myoglobinuria

Associated Injuries

- Tetanic muscle contractures
    - May cause joint dislocations
    - Fractures – neck, long bones
- All electrical injuries should be managed as a trauma patient until associated injuries are ruled out
- Spinal precautions
- Cervical collar should be applied prehospital

“Iceberg Metaphor”

- The damage is worse below the surface of the skin
- Need for surgical exploration of the tissues-fasciotomy
- 21 y/o J.S. Admitted 1/8/25

Electrical Injury

- Fasciotomy / Excision in OR 1/10/25
- STSG 1/22/25

Complications of Electrical Injury

- Immediate:
    - Cardiac arrest
    - Respiratory arrest
    - Fractures from tetanic contractures or falls
    - Extensive muscle damage
    - Myoglobinuria
    - Acute kidney injury

- Long Term:
    - Neurological impairment, memory loss
    - Demylenization of nerves
    - Amputations
    - Cataracts
    - Impotence

Chemical Injuries

Why do people get chemical burns?

- Work related
- Household (cleaning) agents
- Accidental / intentional ingestion
- Assaults

Tissue damage depends on:

- Strength of concentration
- Quantity of chemical
- Manner & duration of contact
- Mechanism of chemical action

Types of Chemicals

- Acids
- Alkalis
- Organic compounds

Steam / Chemical (amine oxide) burn

Common chemical burns

- Radiator fluid
- Anhydrous ammonia
    - Used in methamphetamine production, industrial refrigerant, fertilizer

Emergency Treatment of Chemical Burns

- Protect yourself-wear gloves
- Remove all clothing don't forget shoes / boots
- Brush off powder agents except white phosphorus
- Eye burns- remove contacts, continuous flush from center outwards
- Eye pH

Treatment

- Copious H_2O or saline irrigation
- Remove contacts
- Morgan lens

Emergency Treatment of Chemical Injury

- ABC's
- FLUSH! FLUSH! FLUSH!

- Nebulizer treatment
- Wound care
- Look for hidden burns
- Consider inhalation injury from aerosolized chemicals

Flush! Flush! Flush!

- Copious H_2O
- Ø Neutralizing chemicals
    - Exothermic heat reaction

Hydrofluoric Acid / Concrete / Treatment

- Copious H_2O or saline irrigation

Hydrofluoric Acid

- Copious irrigation
- ↑ Concentration can be life threatening
- IV Ca++

REMEMBER...

☆ ...Tissue damage caused by a chemical will progress until the chemical has been removed or inactivated.

Why go to a Burn Center??????

Advantages of a Burn Center

- Specialized burn educated personnel
- Continual upgrading through experience
- High staff / patient ratio
- Multidisciplinary Team

The Burn Team

Burn Center Referral Criteria

- Partial thickness burns $\geq$ 10% total body surface area (TBSA)
- Full thickness burns
- Burns that involve the face, hands, feet, genitalia, perineum, or major joints
- Patients with concomitant traumatic injuries
- Patients with suspected inhalation injury
- High voltage Electrical injury $\geq$1000 volts
- Lightning injury
- Chemical injury
- Pediatric burns
- Poorly controlled pain

Guidelines for Burn Referral

- https://ameriburn.org/wp-content/uploads/2023/01/one-page-Guidelines for Burn Patient Referral – American Burn Association (ameriburn.org)guidelines-for-burn-patient-referral-16.pdf

94.3% of Burn Center Admissions < 20% TBSA

Transfer Process

- 24 hour availability
- Direct phone call
- Transfer Center
  - 1-866-281-4967
- Conference call with Burn Attending Physician/ Charge Nurse
- Smartphone telemedicine consultation / triage

Stabilization: Prepare to Transport

- Maintain core temperature
- Warm room / transport vehicle / fluids
- Remove all wet soaks, coverings, etc. before transport.
- Keep patient covered; dry sheets; blankets
- Do not delay transfer for debridement or application of topical antimicrobial
- Dressings not required if Burn Center admission
- Documentation

Preparing for the Patient Admission

Glimpse of the Burn Center
Acute Phase

- 48 hours post burn until wounds are covered
- Goals:
  - Prevent infection and sepsis
  - Wound management

Control of Infection

- Environmental Control
- Wound Care and Hydrotherapy
- Topical Antimicrobials
- Infection and Sepsis

Enforce Strict Handwashing

- Waterless hand wash up to five uses between soap and water washes.
- Soap and water wash hands for one full minute.

Daily and Terminal Environmental Cleaning

- Ultraviolet light treatment

Compliance with Infection Control Measures

- Educate all members of the multi-disciplinary team.

Limit Potential for Cross-Contamination

- Reduce unnecessary repeated patient contact
- Enforce strict traffic control
- Restrict access

Woundcare and Hydrotherapy / Proper Planning

- Patient Room vs. Hydrotherapy Room
- Pre-heat the room
- Equipment gathered
- Pre-medicate Patient
- Educate Patient

Bedside Procedure: Unstable patient

Hydrotherapy Area / Shower Trolley

- Hard-wire monitor capabilities
- Ventilator capabilities
- Temperature controlled
- For Acute or Sub-acute patients

Ambulatory Shower

- Lower level patient
- Wound care participation by patient
- May sit or stand

Premedicate

Hydrotherapy & Dressing Change / Cleansing the Wounds

Wound Assessment

- Overall Appearance
- Color
- Drainage vs. Dry
- Area Involved
- Blistered or Intact
- Circumferential
- Pulses

Circumferential Burn

Child Abuse

Patient Weight

Examination

- Burn Attending examines the burn wounds daily to determine changes to treatment plan
- Thorough & concise documentation by Nursing

Physical / Occupational Therapy

Applying Burn Wound Dressings

Topicals
Ag Dressings

- Controls bacterial colonization of wound
- Silvadene
- Sulfamylon
- Collagenase Santyl
- **Sustained Release Silver Products**
- Acticoat
- Mepilex Ag - Safetac Technology

Negative Pressure Wound Therapy VACS in Burn Care

- Post skin grafting

Total Body Wound VAC

Temporary Wound Coverage
Wound is free of debris with minimal or no infection and waiting to be grafted OR wound will heal without grafting.

Xenograft
A graft of tissue obtained from an animal of species other than the recipient.

- Pigskin

Allograft
A graft transferred from on human (living or cadaveric) to another.

- Cadaver skin

Fish Skin Grafts

Permanent Wound Closure

- Surgical Excision
- Harvesting Donor Sites
- Skin Grafting
- Graft Dressings
- Donor Site Care

Early Excision & Skin Grafting

- Split thickness Skin Graft (STSG)
- Sheet Graft
- Meshed Graft

Burn Operating Room

Excising the Burn Wound

Harvesting Donor Sites

Meshed Graft

- Interstices – diamond shaped pattern of perforations created by the mesher at a pre-selection ratio eg: 1:1, 3:1, 6:1

Sheet Graft

- Applied in areas of cosmetic significance
- Intimate contact with wound bed

Extracellular matrix (ECM)

- Primatrix
- ACell

Dermal Replacement Products

- Bi-layer skin replacement system.
- Consists of dermal replacement layer containing collagen
- Consists of epidermal layer of silicone

INTEGRA

- Artificial skin, bilayer dermal replacement matrix

Cultured Epidermal Autografts (CEA)

- Full thickness biopsy
- Lab grown in culture medium
- First harvest in 14 days

Re-Cell

- Spray on skin

Research and the Future

- Stem Cell use in burn treatment
    - mesenchymal stromal/stem cells (MSCs)
    - Bone marrow stem cells
    - Adipose tissue derived stem cells
- Alternative sources of stem cells
    - Epidermis
    - Dermis
- Combination therapy
    - Stem cells and ECMs
- Prospective individualized transplantation therapy

Donor Site Dressings / Care

- Keep donor site clean and dry
- Can be more painful than the burn itself
- Heals in 10-14 days / may have scarring
- Donor Site can be used again

Healed Donor Site

Infection and Sepsis

Signs & Symptoms
Sepsis Warning Assessment Tool - SWAT positive

- Increased Blood Sugar
- Increased or Decreased Platelet and WBC Count
- Increased HR and RR
- Increased Weight Gain without Increased Muscle Mass
- Glycosuria
- Ileus
- Mental Confusion

Complications

- Hypotension
- Lactic Acidemia
- Metabolic Acidosis
- MODS
- Pulmonary Interstitial Edema
- Ischemia of the Gastrointestinal Tract
- Renal Failure

Local /Non-Invasive Wound Infection Signs & Symptoms

- Localize erythema or cellulitis surrounding wound
- Purulent drainage
- Graft loss
- Breakdown of previously healed areas
- Temp > 101.3

Invasive Wound Infection Signs & Symptoms

- Conversion of PT to FT injury
- Focal, dark, discolored eschar
- Rapid separation of eschar
- Necrosis of subcutaneous small vessels
- Edema, erythema, tenderness at wound margins
- Red or black nodular lesion in unburned skin

Fungal Wound / Graft Loss

Promote wound healing and patient recovery with good nutrition...

Nutritional Aspects of Burn Care

- Increased Metabolism
- Increased Catabolism
- Need increased calorie intake
- Supplements & Increased Protein for healing
- Enteral Feeds Vs. Parental Feeds
- Vitamins and Antioxidants

Nutritional Complications

- Weight Loss and Muscle Wasting
- Ileus
- Constipation
- Fatigue – need for rest
- Electrolyte imbalance
- Curling's Ulcer (stress ulcer)
- Tube feedings
    - Critically ill, intubated patients

PAIN CONTROL AND SEDATION

Pain Management

- Manage pain continuously not PRN
- Manage anxiety
- Manage sleep
- Intravenous
- Individual dosing

Pain Behavior

- Inadequate relief of pain leads to:
    - Increase reports of pain
    - More frequent requests for medication
    - Poor cooperation with treatment
    - Increase demanding behavior
    - Increase dependent behavior
    - Lack of sleep
    - Decrease appetite

Types of Pain

- Nocioceptive
- Anatomic
    - Visceral
- Burn Pain
    - Somatic
    - Acute
    - Background
    - Procedural
- Psychological Pain

Pharmacological Treatment of Pain

- Opioids
- Continuous infusion
- Sustained release
- Anxiolytics
- NSAIDS
- Moderate Sedation
- Anesthesia

Non-pharmacological Interventions

- Distraction
- Hypnosis
- Music
- Relaxation
- Aromatherapy
- Virtual Reality

Psychosocial

- Burn Center Recreational Therapist
- Mental Health Therapist
- Daily assessment / interaction with all burn patients & their families

Family-centered Care Approach

- Burn Center Social Worker
- Burn Center Social Worker works with the patient & their family to achieve disposition goals throughout the recovery process.

Making Patients Smile

Lighthearted Moments

Rehabilitative Phase

Acute Setting: Begins at time of admission with continued emphasis during wound healing and recovery.
Recovery Setting: Scar management, reconstruction surgery, and re-integration into society

Rehab

MAJOR GOALS:

- Return patient to his/her pre-burn level of activity
- Facilitate re-entry to society
- Achieve an acceptable functional and cosmetic outcome

Burn Rehab Intensive Care

Burn Scar Management

- Early excision & grafting
- Splinting & positioning
- Exercise
- Mechanical Pressure
- Gel sheeting
- Pharmacologic therapy
- Massage
- Ultrasound
- Dressing techniques
- Surgical reconstruction
- Laser therapy

Splinting & Positioning

- Imposes passive stretch
- Blocks reorganization of collagen fibers

Exercise

- Passive stretch --stretches scar tissue
- Active exercise--prevents joint capsule contractures

Physical Therapy Gym

Complications

- Skin/joint contractures
- Amputations
- Neuromuscular deficits
- Heterotopic calcification
- Pruritis
- Sensitivity to temperature changes
- Hypertrophic scarring

Hypertrophic Scars

Characteristics:

- Erythematous, rigid, firm, raised, pruritis
- Develop 6-8 weeks after healing
- Confined of original wound
- Usually undergo partial spontaneous resolution
- Often associated with contractures

Mechanical Pressure

- Custom made elastic garment
- Worn 18-24 hrs/day
- Accelerates scar maturation
- Modifies disorganized collagen
- Decreases vascularity
- Decreases proteoglycans

Hypertrophic Burn Scar Management

Advances in Scar Management

- Laser therapy
    - Pulsed dye laser (PDL)
    - Ablative fractional CO**2** laser (AFCL)
    - Combination therapy
- Study – pediatric verified burn center
    - Limitations / Challenges
        - Rater bias
        - Patient satisfaction
        - Initiating and discontinuing laser therapy
        - Use of scar scales
- Rigorous, prospective RCTs needed

Pigmentation return / Melanin

Outpatient Management & Home Care

Care of Minor / Moderate Burn

- Clean and dry
- Daily cleansing
- Mild soap
- Minimal topical agent (1/16”)
- Bandages should not interfere with function
- Secure dressing
- Signs of infection
- F/U Outpatient Burn Wound Care Center

Care of Healing Burn

- Pain management
- Pruritis
- Nutrition
- Extreme temperatures
- Rest
    - Sleep
    - Sleep medications
    - Nightmares
- Activity
    - Exercise

Care of Healed Burn

- Protection
    - Brimmed hat
    - Long sleeves
    - Sun block
    - Non-constricting clothes

    - Avoid injury to skin
    - Friction
    - Cut nails
- Moisturizers
    - Emollients
    - Cocoa butter
    - Mineral oil
- Scar management
    - Pressure garments
    - Massage

Outpatient Burn Wound Care Center (BWCC)

- Provides closure of the loop
- New referrals
- New products available designed to
    - Promote patient comfort
    - Decrease or eliminate daily dressing changes
    - Promote faster healing
    - Optimize patient compliance

Cost of Burn Injury

- Injury
- Hospitalization
- Loss of life or loved ones
- Loss of home and possessions
- Loss of jobs or careers
- Loss of self-esteem & independence
- Financial burden

Case Studies

Patient CP 24 y/o

- Admission date: 1/20/21
- Discharged: 1/16/23

H&P

- 24 y/o male admitted on 1/20/21 with 94% - deep full thickness burns
- Mechanism of burn: self-inflicted
- Significant pysch hx, PTSD, depression, borderline personality disorder, anxiety

Admission labs

- CBC: WBC 42.0, Hb 17, Hct 48.7, Plt 240
- BMP: Na 140, K 4.1, HCO3 19, BUN 20, Cr 1.0, Mg 0.9, PO4 3.3, Gluc 133
- Coag's: PT 20.9, PTT 33, INR 1.7
- ABG: 7.35/30/16/245/neg 5 (AC50%/5/500/16)
- CXR: ET Tube
- Toxicology screen: pos opiates

Initial treatment

- Fluid resuscitation 20 liters – 1st 24h
- AC mode, A-line, Triple lumen
- Pulmonary CS for Bronch
- Dressing – SSD full body

Wound management

- 40+ surgeries including multiple STSG / ReCell / CEA / cadaver grafts

Discharged – 1/16/23
LTAC

Case Study
Patient KH – 34 y/o

HPI

- 34 y/o female admitted on 7/15/23 with 44% - partial and full thickness burns to face, arms, legs, torso, and buttocks from a flame burn.
- Mechanism of injury - Accelerant added to a fire pit with a resultant fireball that contacted the patient.

Initial Management

- Intubated by EMS
- Received 3 liters fluid EMS / Trauma
- Fluid resuscitation: Consensus formula estimated 6,880 – 13,760 for first 24 hours
- LR @ 550 ml/hr
- Foley. 1500 ml urine output in trauma bay

Admission labs

- CBC: WBC 35, Hb 12.9, Hct 38.2, Plt. 203
- BMP: Na 135, K 4.3, HCO3 19, BUN 16, Cr 1.2, Mg 1.1, PO4 3.3, Gluc 162
- Coag's: PT 11.3, PTT 22, INR 1.1
- Lactate: 2.0
- CXR: ET Tube

Day 1

- Temp 102.6
- WBC – 9.1
- Extubated – face mask 35%
- Pain control with Fentanyl drip and Hydromorphone

Wound Management

- Silvadene; Collagenase Santyl
- Excision / STSG / ReCell
- Mepilex Ag
- Ketamine
- Blood transfusion

Discharged – 8/10/23

Case Study

- **Glass Fronted Gas Fireplace contact burn**
- Small %BSA Contact burn
- Significant sequelae

Other Types of Diagnoses Treated in Burn Centers

- Severe Exfoliative Diseases (SJS / TEN, SSSS, etc)
- Abrasion injury (road rash)
- Tar burns
- Soft Tissue Infection (necrotizing fasciitis, calciphylaxis, purpura fulminans, etc)
- Frostbite injury

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Student Nurse Seminar Evaluation

Nursing Care of the Patient with a Burn Injury

Thank you for attending the "Nursing Care of the Patient with a Burn Injury" seminar sponsored by the Burn Center at Crozer Chester Medical Center. In order to provide our program for the student nurses in our four-state region, we schedule these seminars at convenient locations that will accommodate several schools. We sincerely appreciate the cooperation of the hosting institutions in making their facilities available without charge for these programs. Be aware, however, that as visitors, we have little or no control over the temperature of the rooms or on occasion, the rescheduling to another room within the building.

We are interested in your evaluation of the program. Please place a [x] check in the column that best describes your learning experience with the topics presented in today's seminar. Suggestions and comments from students and instructors attending our programs are very helpful to the nurse educators who lecture and develop the content for the seminars.

Knowledge gained	Content still unclear	Topics	Comments
		Epidemiology and Burn Prevention	
		Determining Severity, burn depth, % body surface area burned	
		Distinguishing burn types; i.e.: thermal, electrical, chemical, and inhalation	
		Initial assessment and management of burns (first aid / pre-hospital care)	
		Acute Phase of burn care	
		Rehabilitative Phase of burn care	
		Psychological Care of a burn patient	
		Other patients treated in a Burn Center – SJS/ TEN, "road rash", necrotizing fasciitis	
		Outpatient Burn Wound Care Centers	

What were the 3 most significant things you learned today?

Any suggestions for improving the program?