BURN UNIT ORIENTATION

BASICS

- If you don't know, ask!
- Call your senior if you have any questions or doubts.
- If your senior does not answer, call the other senior, or call the attending. If no one else answers, call Attending on call or Dr. Garner.
- IT IS NEVER ACCEPTABLE TO **NOT** CALL FOR HELP WITH ANY PROBLEM, SIMPLE OR COMPLEX.
- The Burn Unit is a "CLOSED" unit. All patients who reside in the Burn Unit complex must be admitted to or co-managed by the Burn Service. Anyone admitted to the BICU is our responsibility regardless of who the other treating physicians are.

READING AND RESOURCES

A. Burn folder – Log onto http://dhs.lacounty.gov or look on the ICU computer in front of the burn administrative offices. In the "Burn Orientation" folder, open the "Burn Materials" folder with the flame in the top right corner and read the articles. New web page is www.lacusc.org with Burn Unit tab on the left column. Password is lacusc.

B. Protocols - Also in the "Burn Orientation" folder is a "Burn Pharmacy Protocols" folder as well as other protocols. Password Protected.

C. ICU book - The ICU Book by Paul Marino is also available on the "Burn Orientation" folder.

D. The "Burn Resident Guide" is a power point introduction to the burn service, also located in the "Burn Materials" folder with the flame.

ROUNDS AND MECHANICS

A. Rounds - are at 7:30 AM daily except 9:30 AM on Friday because of conferences. Weekend rounds should be at 7:30 AM with multidisciplinary team.

B. Multi-disciplinary rounds in the ICU occur in front of patient rooms. Be sure the nurse for each patient is present at the beginning of that patient presentation. Feedback and concerns are elicited from the nurse, PT/OT, pharmacy, nutrition and social work throughout the discussion of the patient.

C. Rounds for patients on the floor occur in the conference room. The intern presents each patient, again eliciting input from the multi-disciplinary team. Orders are typically written as rounds occur.

D. Patient list - On the shared server at \\lacusc\surgery. This is a working, not an official document. The ward list should be updated with the vitals, I/Os, and most recent labs of all patients by the intern on service each morning. An ICU template is also in the burn folder. This outlines all relevant information by system and should be completed for all ICU patients by the second year on service each morning. Copies should be made in the office and the lists ready by 7:30 rounds.

E. ICU notes - documented in CCIS. Typically written by second year on service. Post call resident rounds on the ICU patients, except Sunday morning when they round on all patients. All ICU patients should undergo daily physical exams.

F. Ward notes -document in affinity. Typically written by intern on service. Incoming on call person rounds on the ward. When pre-rounding on the ward, speak to each patient and ask if any problems overnight, confirm with the overnight nurse and examine as indicated by history.

G. H & Ps – All H and Ps should be done in affinity under in patient account, even ICU patients. If H and P is done in the clinic account, then resident should copy note over to inpatient account as soon as one is established. Attending must co-sign H and Ps within 24 hours of admission per hospital policy.

H. Orders- Pain medications, nutrition (including tube feeds), insulin and dressing orders are all on protocolized forms. These need to be completed on admission, after each surgery and upon transfer between the ICU and ward. Additionally on admission, a burn diagram needs to be filled out on each patient. The burn unit has a standardized admit order sheet. Be sure to check off PT/OT, social work and nutrition consults on all patients. See appendices for forms.

I. Labs- pre-albumin and CRP is ordered on all patients for midnight on Sunday and Wednesday. These labs should be ready for rounds on Monday and Thursday mornings. CXR and ABG are automatically ordered for all ICU patients on ventilators. Daily CXRs are not needed on patients with tracheostomy unless something changes in their clinical status.

J. Medical Alter Center (MAC) calls- Transfer request from outside hospitals come through the MAC. When fielding such a call, fill out all details as outlined in the red MAC binder in the ICU. Be sure to get the consulting physician's name and contact number. Inpatient or ICU transfers should be discussed with a senior before accepting. Once accepted, the charge nurse of the ward or ICU should be notified of the impending transfer to allow time for staffing accommodations. See below for further details on transfer criteria.

K. Discharges - Write prescriptions and have clerk send to **outpatient** pharmacy the day before if possible. To be discharged a patient must meet the following criteria:
   - ❖ Have a stable wound.
   - ❖ Have someone trained to take care of their wound.

- ❖ Have resolved needs for inpatient therapy or nutritional support.
- ❖ Be able to tolerate wound care with simple, moderate narcotics.
- ❖ Patients must be able to be discharged home with Norco tablets. Make sure that discharge summaries are completed within 24 hours of discharge. There are medical and legal consequences if these are not completed in a timely manner.

L. Wound exam - Every burn wound should be seen by a physician daily, except patients not undergoing daily wound care. The findings should be communicated to the other team members on or after rounds. Wounds are examined when taken down by the nurses in the late morning to early afternoon. Starting from the time we are notified, **we have 15 minutes to see each wound before it will be redressed**. This is our only chance to see the wound that day. Alert the team so that everyone gets to see the wounds. Please inform attending even if in the OR about wounds they want to see.

M. HIPAA patient confidentiality is in effect for all patients. However, patients with special privacy issues will have a blue strip in the door slot to alert us to go to the nursing kardex for further information about these issues.

ADMISSION and TRANSFER CRITERIA

A. All transfers from outside ER or outside hospitals should go through MAC. See MAC form in appendices.

B. We accept all burn transfers of LA county residents unless there is no nurse or no bed available. Decisions to not accept a patient transfer must be discussed with Attending and Nursing Supervisor.

C. Floor admissions should be called to senior. ICU admissions should be called to senior, then attending.

D. Minor small burns may be treated as outpatients and should be referred to the C5D clinic. Patients not previously seen at LAC+USC will have to register through the ED before coming to clinic.

E. INDICATIONS FOR ADMISSION TO THE BURN UNIT:
1. Children and elderly - Admit second-degree or greater burns totaling > 10% TBSA in children < 10 years or adults > 50 years.
2. Adults - Second-degree or greater burns totaling > 15% TBSA in children and adults between 10-50 years.
3. More than 5% TBSA third-degree burns.
4. Functional or cosmetic risk to eyes, ears, face, hands, feet, perineum, or major joints.
5. Circumferential burns of chest, abdomen, and extremities. See under ICU PATIENT MANAGEMENT, Skin/ Wounds for abdominal compartment syndrome and escharotomy.
6. Major cellulitis - Such as that in the perineal region or involving a large area.
7. Burn inhalation injury gets admitted to ICU.

8. High-voltage electrical injury gets admitted to ICU. See below ICU PATIENT MANAGEMENT, GU.
9. Significant caustic chemical burns.
10. Burns with other major trauma, where the burn poses greatest risk of morbidity mortality.
11. Burns with significant medical comorbidities.
12. TEN/ other dermatology conditions - We accept Stevens Johnson/ TEN transfers if diagnosis proven by biopsy and if 20% TBSA or greater involvement with epithelial loss. Rash without epidermal loss is not indication for admission. We do NOT admit PEMPHIGUS VULGARIS. Use Exsalt for dressing and wound care for TENS and Stevens Johnson.
13. Necrotizing fasciitis / open wounds - We consider transfer of patient with other types of wounds on a case by case basis if they are clean by quantitative tissue biopsy, and have adequate prealbumin, so that they are ready for skin grafting. If patient needs a big flap procedure, transfer to the plastic surgery service should be considered.

BURN PATIENT EVALUATION

A. ABC's

1. Airway and C-spine control - Check for smoke inhalation. Have immediate evaluation of the airway. Check for airway edema and assess for respiratory distress. Call Airway Management team for all intubations. If patient is polytrauma, they may need C spine precautions. Check with senior, fellow or attending regarding placing a C spine collar. C spine can be cleared by ACS team only.
2. Breathing and oxygenation - CO poisoning. DOCUMENT CHEST MOVEMENT AND ADEQUATE PULSE OXUMETRY AND SEE APPENDIX FOR CO POISONING.
3. Circulation - IV access, start warm LR resuscitation, and check circumferential burns for the need for escharotomies.
   - ❖ IV access is a high priority during initial admission and resuscitation.
   - ❖ All invasive procedures require consent; gown, glove, mask appropriately.
   - ❖ Triple Lumen Catheters
     - o Use only abx coated lines.
     - o Have a higher chance of infection in bactermic burn patients.
     - o IJ lines should be done with US guidance.
     - o Femoral lines done lastly when all other sites are exhausted.
   - ❖ Swan Ganz
     - o Assisting nurse will flush the ports, test the balloon, and zero the waveform before you start.
     - o These are not abx coated so need for them should be assessed every three days.
   - ❖ A-line - Sterile procedure. Needed for frequent blood gas monitoring.
4. Disability/neuro exam - Level of consciousness (awake, alert, oriented), pupils, Glasgow Coma Score.
5. Exposure – Exam patient completely and turn patient. Be efficient in order to prevent hypothermia. Use overhead radiant lights and keep patient room door closed.

B. History

1. Brief history after ABCs and then ask a more detailed history, tetanus and immunization. Important to know time, cause, and circumstance of injury. Investigate about smoke inhalation possibility and if event occurred in an enclosed space or not. Inquire about social history, work history (hand dominance).

2. Pediatric burns may be secondary to abuse - Always consult pediatric team to help manage peds burn patients. Alert child protective services or adult protective services if the history and distribution of burn wounds is suspicious for abuse.

3. Admitting Labs - CBC, BMP, Mag, Phos, LFT, prealbumin, CRP, carboxyhemoglobin (if indicated), UA, urine tox screen.

C. Burn Depth Staging

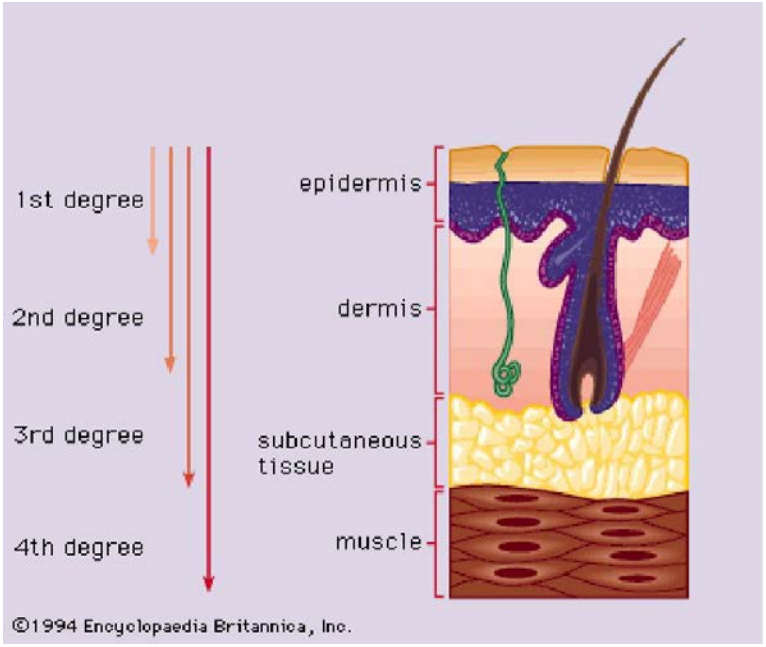
1. Superficial or 1st degree - Involves epidermis, appears as non-blanching erythema. Swollen, dry, painful.

2. Superficial partial or 2nd degree - Involves epidermis and partial dermis, appears as painful blister. Edematous, moist. Painful. Reliable indicator for second degree burn.

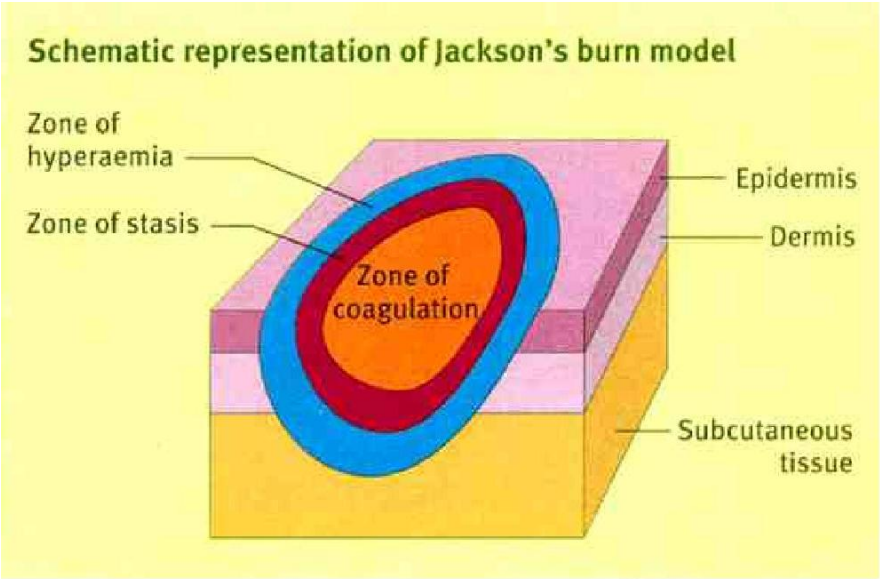
3. Deep partial or 3rd degree - Involves epidermis, dermis, and sub Q.

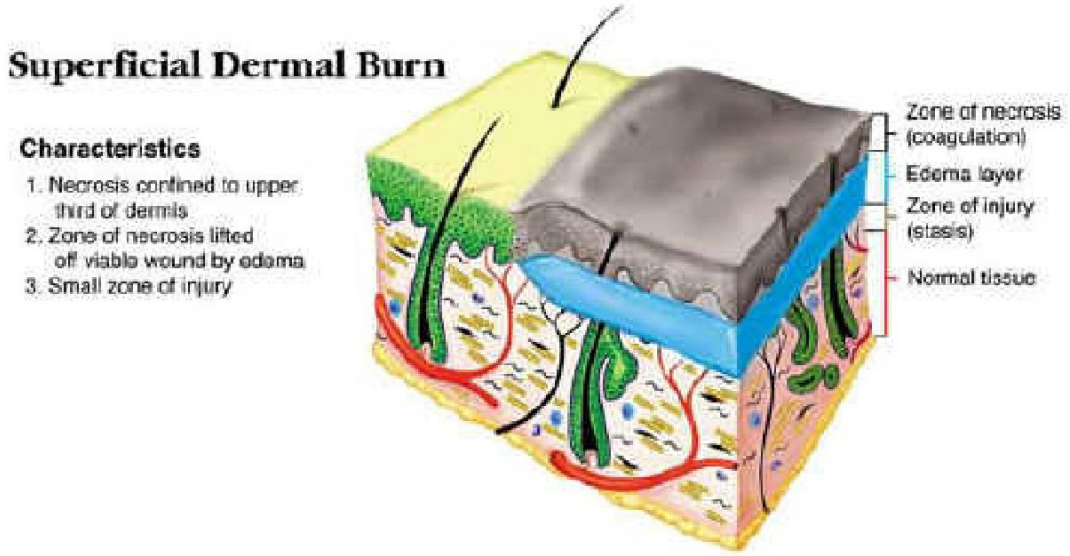
4. Full thickness wound or 4th degree - Involves epidermis, dermis, sub Q, possibly muscle, tendon, bone. Obviously charred, contracted tissue.

5. Unstageable - Wound is usually covered by eschar. Uncertain depth of injury.



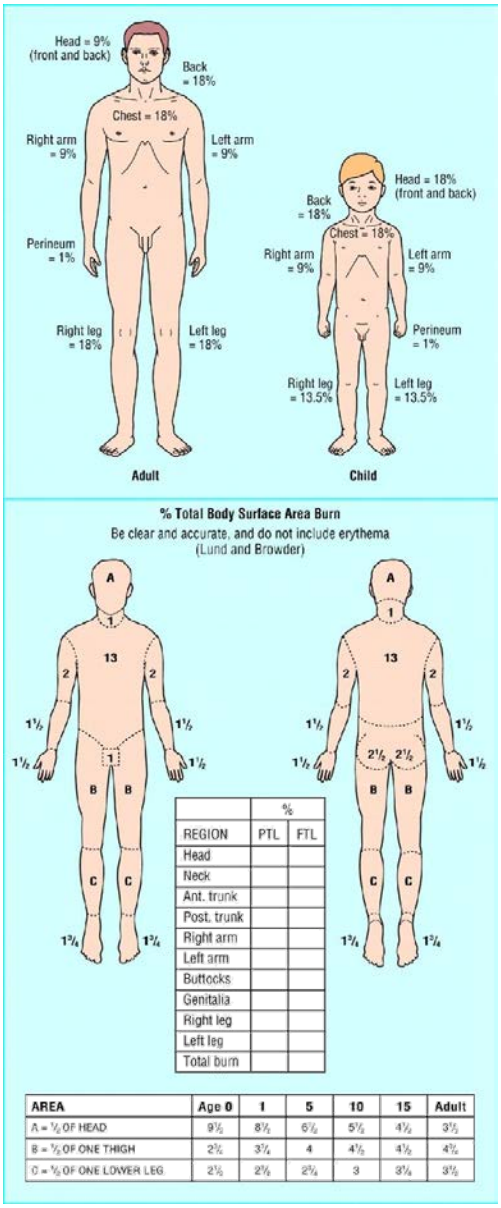
D. Burn zones - Zone of hyperemia, stasis/ injury, and coagulation/ necrosis.





E. Burn Area

1. Quantified as total body surface area burned (%TBSA).
2. Use Rule of Nines to "guestimate" burn size. Applies to burns second and third degree. Do NOT include 1st degree burns. Patient's palm (wrist through fingers) = 1% TBSA.
3. Use Lund Browder diagram for more accurate estimate. This is what is used for our burn diagram.
4. See Appendices (adult diagram) and (peds diagram).



F. Resuscitation - Patients with burn size greater than 20% TBSA should receive a structured fluid resuscitation to maintain tissue perfusion. This fluid should be based on the Parkland (Baxter) formula: 4 ml ringers lactate X % TBSA burned X weight in kg = total fluid requirement for the initial first 24 hours after injury. One half to be given over first 8 hours, and the other half to be given over the next 16 hours.

Age	Calculated volume to begin resuscitation	Timing	Solution
Adults - Parkland	4 ml/ kg/ % TBSA burn	1/2 of total in 1st 8 hours	Lactated Ringer's

		Second 1/2 over next 16 hours	LR
Children 2-12 years	3-4 ml/ kg/ % TBSA burn	First 24 hours	LR
Infants and young children 0-2 years	3-4 ml/ kg/ % TBSA burn + maintenance	First 24 hours	LR + D5LR (for maintenance)

1. For small children and infants, resuscitation fluid is in addition to maintenance IVF.

2. MAINTENANCE CALCULATIONS for adults and children:
   1st 10 kg: 4 cc/kg/hr
   2nd 10 kg: 2 cc/kg/hr
   Each kg above 20kg - 1cc/kg/hr

3. For burn inhalation, fluid requirements will be higher, add 10-20% to TBSA.

4. For burns larger than 30% in patients over age 16, give vitamin C at 66 mg/kg/hr continuous IV for the first 24 hours, will be used as part of the resuscitation fluids to decrease fluid requirement and decrease edema formation. Vit C is used to scavenge O2 free radicals. See ascorbic acid protocol and Ascorbic acid infusion rate flow chart under Pharmacy protocols in Burn Web-site.

5. The Parkland formula is an initial estimate of fluid needs. Hourly fluid administration should be adjusted to the pt's UOP to maintain a UOP of 0.5 ml/kg/hr in adults and 1 ml/kg/hr in children weighing less than 30 kg. Increase or decrease IVF rate by 1/3 if UOP 1/3 below or above goal for 2-3 hours, respectively. Discuss these changes with the senior resident on call.

6. If resuscitation is not proceeding as expected, or urine output is below expected, consider:
   a. Incorrect estimation of burn size
   b. Additional, non-cutaneous injury requiring fluid resuscitation
   c. Cardiac or renal disease

7. After the first 24 hours, colloids may decrease fluid requirements

G. Burn dressing – Discuss wound care needs with attending or Fellow. All burn wounds should be treated with a topical antimicrobial ointment. Decide on a topical treatment and dressing that promotes healing, prevents infection, and protects deeper tissues. Daily and more frequent dressings must be washed off completely before reapplying dressing.

   1. Superficial wound with healthy tissues. Mepilex Q 2-5 days. Can be used for donor sites as well. (consider 3-5 days for Mepilex. 2 days negates somewhat the psychological, and economical benefit of the silver dressing)

2. Deeper wound, necrotic tissue, need for daily debridement - 1% Silvadene cream QD, 8.5% Sulfamylon cream QD.
3. Deeper wound, clean, no need for daily dressing - Exsalt Q 3-5 days, 5% Sulfamylon irrigation Q 3-5 days. Make sure to keep Exsalt well irrigated.
4. Face wound - Bactroban 2X daily, Aquacel AG and trim off lifted healed portion or change prn weepy from edema.
5. Ear wound – 3rd degree ear burn. 8.5% Sulfamylon cream QD.
6. Diabetic insensate foot wound - 8.5% Sulfamylon cream QD. Encourage pt to walk on it. Elevate foot when at rest. At higher risk for cellulitis.
7. Hand wounds may need Coban dressing changes. Check with OT
8. Perineum: Keep area as clean as possible. May need foley or rectal tube. Check with nursing. Watch for worsening perineal edema.
9. Burn dressing postop - Most patients with meshed grafts will be in 5% Sulfamylon soaked burn dressing. See Burn Center Dressing Order Form

H. Other Wound Management Concerns

1. Wound Infection – Assess wound by taking quantitative cultures - Send approx 1 gram of tissue in a test tube with no solution or preservative. Nurse will tube it to micro lab. Call micro to verify that they received specimen and process it in a timely manner. Sample can not be dried out when received. Wound should be clean with less than 10^5 colonies per gram from a quantitative wound culture for possible surgical closure.

2. Stevens Johnson/ TEN - After resuscitation has started and patient with good UOP, premedicate with Tylenol and Benadryl, and **start IVIG protocol**. Usual dose is 1 g/kg/day X 3 days or 3 g/kg total. Steroids are harmful for TEN, so NO STEROIDS. Admission to BICU IS A BIOPSY PROVEN DIAGNOSIS AND GREATER THAN 20% TBSA

3. Decubitus Ulcers
   a. Relieve pressure - Use a low air loss bed, and frequent turning schedule by RN
   b. Stage the wound
      i. Superficial or stage I - Involves epidermis, appears as non-blanchable erythema
      ii. Superficial partial or stage II - Involves epidermis and partial dermis, appears as painful blister
      iii. Deep partial or stage III - Involves epidermis, dermis, and sub Q
      iv. Full thickness wound or stage IV - Involves epidermis, dermis, sub Q, possibly muscle, tendon, bone
      v. Unstageable - Wound is usually covered by eschar

Avoid and correct wound healing deterrents such as steroids, radiation, chemo, tobacco products, and uncontrolled diabetes.

WARD PATIENT MANAGEMENT

A. Pain control - See pharmacy pain and sedation protocols. Give enough pain meds while patient in hospital with open wound. No MS Contin or morphine elixir as outpatient. Percocet is not typically used on the ward

B. Nutrition / GI - Start the day of admission. Order prealbumin on Sundays and Wednesdays. If patient has poor oral intake, consider dobhoff. All patients get nutrition consult.

C. PT / OT - OT (face, upper extremity burns) PT (lower extremity burns) consults on most patients. Important for maintaining ROM, edema, scars, and recovery with end goal of returning to independent living. Patient should be moving well enough from PT/OT standpoint and independently ambulating with or without devices

D. Family teaching - For discharge planning, family has to learn any dressing, so the sooner they start, the more chance they have to get comfortable with it.

E. Psychosocial - Burn injury like any trauma, causes stress and grieving.
   1. Signs of stress include nightmares and flashbacks, difficulty concentrating or difficulty with memory, fear, anxiety, irritability, intense anger, emotional outbursts.
   2. Stages of grieving include denial, shock, disbelief; anger, rage, hostility; bargaining; guilt; depression, sadness; acceptance, resolution.
   3. There are also support groups for burn patients after they go home.

ICU PATIENT MANAGEMENT

A. Neuro
   1. Pain control - See pharmacy pain and sedation protocols. Give enough pain meds while patient in hospital with open wound. FLACC pain scale. Preferred ICU pain med is IV morphine.

The FLACC Pain Scale

	SCORING		
CATEGORIES	**0**	**1**	**2**
FACE	No particular expression or smile	Occasional grimace or frown, withdrawn disinterested	Frequent to constant frown, clenched jaw, quivering chin,
LEGS	Normal position or relaxed.	Uneasy, restless, tense.	Kicking, or legs drawn up
ACTIVITY	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
CRY	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
CONSOLABILITY	Content, relaxed	Reassured by occasional touching, hugging or talking to, distractible	Difficulty to console or comfort

2. MAAS - Daily 6:00 AM SEDATION HOLIDAY and sedation score should be considered for patients in ICU on sedation drips. Preferred Burn ICU sedation drug is versed gtt or scheduled or IV gtt Ativan-see ICU Sedation under Pharmacy protocols. Long standing high doses of benzodiazepine should be weaned slowly per protocol. Haldol is useful for ICU delirium agitation. See Haloperidol (IV) Protocol. Be alert for alcohol withdrawal in newly admitted patients. See ETOH withdrawal protocol, order forms & Assessment Documentation Forms. May use Seroquel for agitation as well. When using haldol or serquel, make sure to check QTc interval as these medications can cause a prolongation.

Motor Activity Assessment Scale (MAAS)

SCORE	DESCRIPTION	DEFINITION
0	Unresponsive	Does not move with noxious stimulus #
1	Responsive only to noxious stimuli	Opens eyes OR raises eyebrows OR turns head toward stimulus OR moves limbs with noxious stimulus #
2	Responsive to touch or name	Opens eyes OR raises eyebrows OR turns head toward stimulus OR moves limbs with when touched or name is loudly spoken
3	Calm and cooperative	No external stimulus is required to elicit movement AND patient is adjusting sheets or clothes purposefully and follows commands
4	Restless and cooperative	No external stimulus is required to elicit movement AND patient is picking at sheets or tubes OR uncovering self and follows commands
5	Agitated	No external stimulus is required to elicit movement AND attempting to sit up OR moves limbs out of bed AND does not consistently follow commands (e.g., will lie down when asked but soon reverts back to attempts to sit up or move limbs out of bed)
6	Dangerously agitated, uncooperative	No external stimulus is required to elicit movement AND patient is pulling at tubes or catheters OR thrashing side to side OR striking at staff OR trying to climb out of bed AND does not calm down when asked

Noxious stimulus, suctioning OR 5 secs. of vigorous orbital, sternal, or nail bed pressure

3. Glasgow Coma Scale – Calculate Coma Scale

EYE RESPONSE (E)	Open Spontaneously	4
	Open to verbal command	3
	Open in response to pain	2
	No response	1
VERBAL RESPONSE (V)	Talking / Orientated	5
	Confused speech / Disorientated	4
	Inappropriate Words	3
	Incomprehensible sounds	2
	No response	1
MOTOR RESPONSE (M)	Obeys commands	6
	Localizes to pain	5
	Flexion / withdrawal	4
	Abnormal flexion	3
	Extension	2
	No response	1
	TOTAL	3-15

4. Restraints - Must be ordered daily for intubated or confused ICU patients at risk of self extubation. See restraint order sheet.

B. Respiratory - After Inhalation injury, the onset of upper airway obstruction from edema can be very rapid. Anyone with suspected upper airway injury should undergo laryngoscopy. If abnormal exam, intubate the patient. If minimally abnormal, re-examine in 6 hours. If normal, no further exams are warranted.

1. HOB elevation - Automatically done by nurses.
2. DL, bronchoscopy, quant BAL - Equipment and supplies are in bronch room next to resident work room. Bronch is a sterile procedure; so gown, glove, and mask appropriately. Consult ENT for Diagnostic larynoscopy to rule out inhalation injury when there is concern. Remember to aspirate copious water through bronch suction port after the procedure so the sputum won't dry on and clog the suction port. Wipe the light source and the bronch down with disinfectant wipe before putting away in storage and in dirty bronch room, respectively.
3. ETT size, cuff leak, tube exchanges - For men, 7-8 ETT is adequate; for women 6.5-7.5 depending on height, size of patient. Check cuff leaks on intubated burn inhalation patients. Tube exchanges should be done by senior, fellow, or anesthesia under controlled situation.
4. Ventilators Most patients who require respiratory support are treated with the high-frequency percussive ventilator (HVPV) until their serious pulmonary dysfunction has improved. Thereafter, weaning can be accomplished with pressure support. **There is**

seldom a role for SIMV in the Burn unit. CHECK WITH SENIOR OR ATTENDING BEFORE PUTTING SOMEONE ON SIMV.

5. HFPV - This vent requires a cuff leak, allows us to use lower FiO2 of 25%, and delivers pulmonary toilet. Do not change the vent buttons without asking RT, or notifying RT. Usual initial settings are respiratory rate/ of percussions15/500, peep/ CPAP of 2/10, and PIP of 20. Adjust the CPAP for oxygenation and adjust the PIP for ventilation. See VDR set-up, VDR MANAGEMENT pocket card, Weaning Protocol.
6. FiO2 - Patients should be treated with an FIO2 of 0.25%. Brief periods at higher O2 levels are used to increase off-diffusion of CO, for 1 hour, or for period of change in mechanics. ABG with pO2 in the 80's or greater is adequate. If support is needed to increase PaO2 increase levels of PEEP or CPAP. Report and discuss the use of higher FIO2s with seniors and make sure that Dr Garner knows you are doing this. DO NOT INCREASE FIO2 GREATER THAN 0.25% unless necessary for emergent life-saving treatment.
7. Inhalation injury - Smoke inhalation causes injury in 3 different ways.
    a. CO poisoning occurs during and immediately after exposure.
    b. Upper airway swelling happens within minutes to hours after exposure
    c. Parenchymal lung injury from toxic byproducts of combustion occurs within hours to days after exposure.
    d. Diagnosis - History of smoke, hot gas, steam exposure in enclosed space, and physical findings of facial burn, singed nasal hairs, soot in oral pharynx, coughing, hoarseness, stridor are suggestive of inhalation injury. A positive DL or bronch will be obvious with soot, erythema, and edema visualized in the nares, pharynx, and airways. A negative bronch does not rule out inhalation injury, but does make it less likely. Carboxyhemoglobin will be elevated early in inhalation, but treatment with 100% oxygen removes it within 1 hour.
    e. Treatment - Heparin 10, 000 units Q4 hr neb, alternating with mucomyst 20% 4 ml Q4 hr neb + albuterol 2.5 mg Q4 hr neb, (+/- atrovent 0.5 mg Q4 hr neb). See appendices for Inhaled heparin protocol.
8. Weaning/ extubation - Patient must have good cuff leak before extubation. Spontaneous breathing trial is the best weaning trial in burn ICU. In order to wean/ extubate successfully, patient should be hemodynamically stable, have good cuff leak and oxygenation, be able to cough forcefully, and do not need major surgery in the near future. Notify the senior or attending before extubation. Be present in the patient room or in front of the room for the extubation in case something goes wrong. For chronically ventilated patients, continued mild ARF, and risk of de-recruitment make extubation from HFPV risky. These patients should be transitioned to Pressure support and weaned to minimal settings before extubation.
9. Tracheostomy - Trach early for severe burn inhalation injury that you know will take the patient weeks to heal. This will allow better oral care and help decrease ventilator associated pneumonia. Drs Garner and Carey do their own trach with you for the more straight forward patients. Call ENT for difficult morbidly obese patients with thick short necks. Standard trachs are in supply cart, secret stash of special trachs are in bronch store room. Tracheostomy may be needed for severe facial burns as well. Call ACS for bedside percutaneous tracheostomy.
10. Decannulation - Criteria include no more airway swelling, good oxygenation, minimal secretions, ability to cough to clear secretions and protect airway with no more surgeries needed. Patient can also be decannulated in clinic after discharge.

C. Cardiovascular

1. Monitoring - Swan, SVO2, CVP, pulse, BP, daily weight
    a. A CVP from a central line is reliable for determining volume status and filling pressure in most patients.
    b. A Swan Ganz pulmonary artery catheter is essential in patients where the volume and resuscitation status is unclear. The most valuable information is the SVO2 which tells you whether the tissues are oxygenated and whether oxygen is being extracted. Other valuable information includes the CI which tells you how hard the heart is working and compensating for the burn and related complications. The SVR/ SVRI tells you the status of vascular tone or vasodilatation.
    c. Daily weight is surprisingly useful in burn patients because they have large and difficult to predict insensible losses. The daily weight will give you a good idea of whether the patient is really 4-5 liters positive or whether it has all evaporated and seeped through the wounds. Tachycardia combined with hypotension is a good indicator of volume status. Although hypotension occurs late, the diastolic pressure will drop and pulse pressure will widen before the systolic pressure or MAP drops.

2. Pressors, inotropes -Initiation or titration of vasopressors should be guided by a PA catheter and SVO2 measurements during the first days of pressor use.
    a. Levophed (norepinephrine) is commonly used alpha agonist in the Burn ICU to treat vasodilatation from sepsis. However, keep in mind that it does not work if the patient is too acidotic, so correct for respiratory and metabolic causes of acidosis. A small amount of levophed may be needed when the patient has a larger TBSA. This is the response to a profound vasodilation that the patient may have. Discuss with the fellow or attending.
    b. Phenylephrine is used as an alpha agonist.

3. Arrhythmias
    a. Atrial fibrillation should be worked up for correctable causes such as electrolyte depletion, volume depletion or possible volume overload. Acutely, it can be rate controlled with amiodarone, beta blocker, or diltiazem. Cardioversion is ideal for patient survival outcomes when the patient is refractory to medical management of a fib.
    b. Sinus tach - Burn patients have sustained tachycardia from pain, inadequate resuscitation, or hyper metabolism from SIRS, treat according to cause.
    c. Some burn patients demonstrate a prolonged, non-physiologic tachycardia. If functional reasons for this are excluded, beta blockade is good treatment. Preferred drugs are metoprolol for adults and propranolol for children. Initial treatment with a short-acting beta-blocker (esmolol) is often the safest initial response, followed to a longer acting drug when the treatment goals have been achieved in an otherwise stable patient.

4. Diuretics - Do not give lasix, aldactone, HCTZ without attending approval. Diamox is sometimes used to treat metabolic acidosis especially in ventilated patients with adequate volume status. **CHECK WITH SENIOR OR ATTENDING PRIOR TO STARTING MEDICATION. DO NOT GIVE LASIX WHEN A PATIENT HAS CLINICAL SIGNS OF VOLUME OVERLOAD SUCH AS PERIPHERAL**

EDEMA.

D. FENutrition

1. LR versus NS/ albumin/ blood product - Initial 24 hour resuscitation fluid is LR +/- ascorbic acid. Maintenance fluid or boluses will vary depending on patient needs.
2. Electrolytes should be checked and replenished aggressively. K, Mag, Phos, are often decreased in the early resuscitation and feeding times. Hypernatremia is usually due to excess isotonic fluids such as maintenance fluid or when the patient is febrile and native physiology will concentrate Na. It is seldom the result of inadequate water. Give free water with tube feeds thoughtfully. Treat hypernatremia by assessing the solutions that drips are made in and minimize isotonic solutions. Calculate free water deficit. First line of treatment is free water down the doboff. Second line is D5W through the IV.
3. Ulcer prophylaxis, GIB - GI prophylaxis (Protonix) on everyone not receiving intra-gastric tube feedings and critically ill patients.
4. Feeding starts on the day of admission because of hypermetabolism, hyper-catabolism, and the need to support wound healing. Feed patients via GI tract to decrease bacteria translocation and sepsis. Basal energy expenditure increases with burn size. Calculate feeds based on actual weight on arrival, not ideal body weight. Harris Benedict and Curreri are two commonly used formulas. Feed enough calories and protein to have prealbumin = 17 in adult patients, commonly 30-60 kcal/kg for most large burns.

    a) Curreri formula - Adult

    25kcal x weight (kg) + 40 kcal x %BSA burned

    b) Hildreth + Associates - Child under 1 year of

    age 2100 kcal/m^2 BSA/day + 100 kcal/m^2

    burned/day

5. Place a dobhoff tube in intubated patients, those who are unable to eat their required protein and calories to maintain goal PAB, or those with >20% TBSA burn.
6. Tube Feed Formulas - See Burn Nutrition Order Form and Burn Nutrition Pamphlet and Tube Feed Composition Tube Feeds Formulary in appendices. Bene-protein supplement is added per nutrition recommendations.
7. TPN - TPN must be ordered before noon daily, when needed for patients with GI complications such as ileus, obstruction, Ogilvie's, abdominal compartment syndrome. TPN will arrive at 5 PM.
8. Multivitamins, vitamin A, vitamin C, zinc, glutamine are ordered according to size of burn and tube feeding formula used. See vitamin order sheet. Vit A helps glycogen synthesis, collagen synthesis, and cross-linking. Vit C is used in collagen hydroxylation, tissue regeneration. Zinc promotes protein synthesis. Glutamine is good for enterocytes. Oxandrolone helps prevent loss of muscle mass-see Oxandrolone Protocol under Pharmacy Protocols.
9. Multivitamins, vitamin A, vitamin C, zinc, gluta helps glycogen synthesis, collagen synthesis, and cross-linking. Vit C is used in collagen hydroxylation, tissue regeneration. Zinc promotes protein synthesis. Glutamine is good for enterocytes. Oxandrolone helps prevent loss of muscle mass-see Oxandrolone Protocol under Pharmacy Protocols.

10. Prokinetics - Erythromycin and metaclopromide are commonly used. Erythromycin is more effective, but the IV form of it increases QTC interval in ICU patients. Reglan increases ICU psychosis.

11. G tube - Rarely indicated unless patient will still not be able to eat after burn issues are resolved. Usually G tubes are done with IR.

E. GI

1. Abdominal compartment syndrome (ACS): Can be caused by over resuscitation with circumferential abdominal burn eschar leading to high transmitted intra thoracic pressure. Possible causes are from ventilator; obesity; abdominal surgery and bowel edema; ascites; constipation, ileus, obstruction, or other GI stasis problems. See Abdominal Compartment Syndrome protocol
   a. Intra abdominal hypertension is defined as intra abdominal/ bladder pressures >18 mmHg
   b. Abdominal compartment syndrome is defined as pressures =/> 20 mmHg with new or progressive organ failure such as acute renal failure.
   c. Intra abdominal pressure is most accurate when patient is paralyzed for the measurement. More important is maintaining, abdominal perfusion pressure =/> 60 mmHg (MAP-IAP). See Neuromuscular Blocking Agent guidelines.
   d. Paralysis should not be the treatment for ACS, but rather an extemporizing measure while the real cause is found and treated. Occasionally, patient will need decompressive laparotomy if the cause is not successfully treated.

2. Ogilvie's – Most often the result of electrolyte abnormalities, constipation and narcotics. Prevent it with electrolyte repletion, bowel regimen, and attention to GI function. See Neostigmine guidelines for GI stimulation.

F. Heme / ID

1. DVT prophylaxis - Because of hypercoagulability in burns, patients should have SQ heparin for DVT prophylaxis unless they are seen to be walking in the hall multiple times a day. Treat with Sub Q heparin 5000units TID.
2. Transfusions - Blood loss in the OR is typically underestimated, transfusing in the OR during/ after debridement is the best time. Transfuse in the ICU or ward if Hct < 24 or if patient symptomatic.
3. Fever work up - Culture for fever equal or greater than 39 C. Include blood, UA, urine culture, quantitative BAL for sputum culture, and quantitative culture of any suspicious wound. Check lactate acid levels. Lower grade fever without other signs or symptoms of infection most likely represents SIRS from the burns. However beware of very immune compromised patients and elderly patients who are unable to generate a fever to fight infection.
4. Abx - See Trifold- Burn Pharmacotherapy Reference Guide and Burn Antibiotic Protocol for usual pathogens and usual abx. Narrow spectrum antibiotics are preferred unless patient is sick and septic with cultures are already pending. Be aware that MDR pseudomonas is prevalent in our Burn ICU. Also, patients on high dose or broad spectrum antibiotics are empirically given probiotics.
   a. Quinolones are not allowed in burn pts without attending approval.
   b. Colistin requires ID approval, see Colistin Guidelines.
   c. Inhaled antibiotics are useful for lung infection requiring tobramycin and otherwise

systemically toxic antibiotics. See Intratracheal Antibiotic Protocol.

5. Hand washing and sterile techniques for procedures - This is last but not least, because burn patients have lost their major defense barrier. Hospital acquired infections is so easily preventable by conscientious doctors and nurses. Hospital keeps stats of such things for quality control and comparison to other units and other hospitals.

G. GU

1. UOP goals - UOP of 1-1.5 ml/kg/hr in children is adequate and UOP of 0.5-1 ml/kg/hr in adults is adequate. Under resuscitating will cause wounds to convert to full thickness. On the other hand, over resuscitating, especially in circumferential trunk and extremities burns will cause abdominal compartment syndrome and compartment syndrome respectively.
2. Rhabdomyolysis and myoglobinuria can occur in high voltage electrical injury, crush injury, and morbidly obese patients undergoing long surgeries. Sodium bicarb and Mannitol 12.5 g/ liter resuscitation fluid may be used to maintain UOP at 1-1.5 ml/kg/hr in this situation. Discuss these treatments with seniors before starting. Check CK in order to see which way the values are trending.
3. ARF - Usually due to inadequate perfusion from inadequate resuscitation, or impending sepsis and vasodilation. Check FENA, FE Urea, and casts in the urine will help differentiate between prerenal and renal causes.
4. HD, CRRT - CRRT is ideal for patients with ARF and hypotension. However, the continuous nature of this mode of dialysis can cause loss of small proteins and albumin, as well as cause some antibiotic and other drug levels to be lower than expected.

H. Endocrine

1. DM glucose control - Glucose goal is an average of 150 or less (range 100 - 150) for optimal wound healing. When patient not on tube feeding, this level may be achieved with diet alone. Patients who are consistently hyperglycemic need to transfer to ICU for insulin drip, especially immediately after surgery. Once more stable, can convert to q8h NPH insulin plus ISS for patients on ATC tube feeding. See insulin gtt and insulin SS order sheets. If patient is not on tube feedings and diabetic, make sure to start home medications.
2. Make sure TFTs are checked in patients who are hypothyroid or hyperthyroid. Adjust dosage accordingly.
3. Anabolic steroid – Some steroids, glucocorticoids hinder wound healing. However, the androgen oxandrolone will help prevent loss of muscle mass. See Oxandrolone guidelines for patients > 18 years old with 20% TBSA or larger burns. LFT's should be followed in patients on oxandrolone. Consider oxandrolone in younger patients (> 4) with large TBSA burns (need pediatric service approval).
4. Steroid deficiency - For trauma induced deficiency, hydrocortisone is good as replacement therapy because of relatively stronger mineralocorticoid versus glucocorticoid effect.

I. Musculoskeletal

1. See above under WARD PATIENT MANAGEMENT.
2. Escharotomy - For compartment syndrome from circumferential burns and over resuscitation/edema. Remember, loss of pulse is a very late sign of compartment syndrome. Other signs are distal cyanosis, pain, paresthesia, decrease in pulses, or inability to ventilate in circumferential burn of chest and abdomen. Compartment

pressures can be measured with values of > 25 being the guide point for escharotomy. Escharotomy is done at the bedside using IV narcotic and sedation, betadine prep, cautery or scalpel. Make incision just deep to the burn skin of the anterior axillary chest/ abdomen and mid lateral or medial aspect of limb affected. See escharotomy diagram in appendices.

3. Make sure patients are getting some sort of activity daily
4. Consider ROM of all four extremities under general anesthesia in those patients that have been in the hospital for months and have > 20% TBSA.

J. Psychosocial - See above under WARD PATIENT MANAGEMENT.

OR MECHANICS

A. Scheduling cases for OR - Remind the senior or NP to book OR time before 10:00 AM the day before surgery. Line up forms need to be filled out and given to the OR scheduling office in a timely manner!! After a schedule has been submitted, changes to the day of surgery must have a new line up form filled out. The OR front desk must be notified about the changes.

B. Consents: OR consents must be completed and in the chart prior to day of surgery. Include the site of burn debridement. Do not state “burns”. Include any possible donor site. Consent for procedures and make sure it is done for floor and ICU patients.

C. Go to surgery whenever not on call or floor work not too busy. One R2 or more senior resident and above should be in the OR with the patient before anesthesiologist will intubate, use this time to pre-write post op orders, PADI, and skeleton brief op note.

D. Patients with significant burn injuries should have their surgeries staged into physiologically sound procedures. The planned extent of burn wound to be debrided and grafted should be based on patient stability and the surgical requirement. Consideration should be given to position changes and the time needed to fix grafts in “high-demand” locations like hands and face. Excessively large operations increase the risks of hemodynamic instability, coagulopathy and hypothermia. In general, no more than 2 body areas (arms and chest; both legs) or more than 40% TBSA should undergo surgery at one operative setting. This operative planning should ALWAYS be discussed with the attending staff for the day.

E. Antibiotics – All patients should get peri-operative antibiotics. Single intra-operative dose for small procedures or reconstruction cases, and more broad coverage antibiotics that should be continued for 24 hours for sick or chronic patients.

F. Position - Plan for access to your donor sites as well as debridement sites.

G. Prep, drape- Only clip where the areas of planned surgery are very hairy.

H. Debridement – Grafts can only be placed in well-debrided wounds. Recognizing what level is sufficient can be difficult. There will be little bleeding if you have injected tumescent solution, watch for shiny healthy fat and tissues instead.

I. Donor Sites: Have a thoughtful and meaningful discussion with the patient. Discuss where they want their donor sites from. Make sure to communicate with the patient potential for pain, hypertrophic scarring and type of graft they want. Discuss the risks and benefits of sheet grafts versus meshed grafts. Consider lower backs, buttocks and lateral iliac crest as sites for females.

J. Harvesting - Split thickness for most grafts, 12/1000 inch thickness usually, 10/1000 for children or elderly, thicker for faces.

K. Grafting - Fibrin glue sheet grafts. Check for seroma on POD 2 if you did not use fibrin glue or if you are concerned about the stability of some after you finished securing graft. Otherwise check grafts on POD 5-6.

L. Integra, cadaveric - Integra acellular dermal matrix can be used to graft debrided areas for large burns when there is inadequate donor site for SG. Only use in meticulously debrided wound beds and treat for at least 7 days with 5% sulfamylon irrigation to prevent infection. We don’t use cadaveric skin; it is predictably rejected by the body and does not leave a matrix behind.

M. Splints - Splint grafts that cross or are near joints. OT/ PT will often come to OR to wrap Coban or apply splints for us.

N. Post op orders - Don't forget to order irrigation if you placed red rubbers in the dressings. Also fill out the burn dressing diagram.

O. Dictations, ORSOS - Fill out ORSOS at the end of the case. Primary surgeon should dictate right away after surgery. If you are delinquent, the attending of record will be suspended from booking any OR time, and the whole team will be upset.

P. Family Communication - Senior resident or fellow should talk to family after every surgery and procedure.

Q. Special consideration - morbidly obese pts require planning and cooperation between anesthesia, surgeon, and nursing in terms of additional OR equipment and positioning. Because of cardiac risks and risk of rhabdomyolysis, these cases should be as short as possible without compromising quality of care.

CLINICS

- Routine outpatient Clinics are in A5B on Monday and Wednesday afternoons, 1:00 PM till finished. **EVERYONE IS EXPECTED TO BE IN CLINIC.** Please communicate with Chief Resident or Fellow about any conflicts
- 24 hour clinic in the C5D inpatient ward for ER patients.
- Clinic for Kaiser or other insurance patients in the C5D inpatient ward on Tuesday, Thursday, or Friday. Please do not schedule before 1200.

A. Initial Evaluation - See above.

B. Many patients will require pre-medication prior to debridement. The nurses can be a helpful resource in deciding the amount of medication required for a given debridement. Resident must see patient and write a note. Orders must be written prior to administration per policy. Verbal orders are not allowed.

C. Dressing –See above

D. F/U - Usually in 2 days after initial presentation, then space out to 1 week or more as the wound heals.

E. For any patient with private insurance, the clinic note must specifically denote that the patient requires continued care in a burn specialty clinic.

F. Post burn and post graft scarring - Sunblock, lotion, and massage are recommended for everyone.

G. Hypertrophic granulation/ scar - Apply silver nitrate to hypertrophic granulation. Hypertrophic scar can be treated with lotion and massage, ACE wrap, compression garment, silicone tape/ sheet, steroid injection in clinic or in OR.

APPENDICES

- MAC form
- Admit orders
- Admit burn diagrams adult and peds
- Ascorbic acid protocol
- Ascorbic acid infusion rate flow chart
- Burn Center Pain Management *Overview of Burn Pain Management*
- Adult Burn ICU Sedation Guidelines
- Haloperidol (IV) Protocol
- ETOH withdrawal protocol/Order form Restraint order sheet
- VDR set-up
- VDR MANAGEMENT pocket card
- Weaning Protocol
- Inhaled heparin protocol
- Burn Nutrition Order Form
- Burn Nutrition Pamphlet Tube Feeds Formulary Vitamin order form
- Abdominal Compartment Syndrome protocol
- Neuromuscular Blocking Agent protocol
- Neostigmine Ogilvie Syndrome guidelines
- Trifold- Burn Pharmacotherapy Reference Guide
- Burn Antibiotic Protocol
- Colistin Guidelines
- Intratracheal Antibiotic Protocol
- IV Insulin protocol
- SS insulin orders
- Oxandrolone Guidelines
- Burn Center Dressing Order Form with Post-Op Surgical Dressings
- Escharotomy diagram
- IVIG protocol for TEN patient