

BURN UNIT ORIENTATION

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.

IT IS NEVER ACCEPTABLE TO NOT CALL FOR HELP WITH ANY PROBLEM, SIMPLE OR COMPLEX.

READING AND RESOURCES

- A. Burn folder - 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 R corner and read the articles.
- B. Protocols - Also in the "Burn Orientation" folder is a "Burn Pharmacy Protocols" folder as well as other protocols.
- C. ICU book - The ICU Book by Paul Marino is also available on the "Burn Orientation" folder.
- D. The "Burn Resident Guide" is a powerpoint 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, but may vary if OK with all parties. Junior on call on Sunday should arrive at the hospital at 10:00 AM, after rounds and most of the work has been done, this is for the sake of clinic coverage on Monday, when the on call resident from Saturday will be off.
- B. Patient list - is on the ICU computer in front of the burn administrative offices, in the "DO NOT DELETE" folder. The resident on call should update this daily. This is a working, not an official document.
- C. ICU notes - are written in Eclipsys. 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, at least examine neuro, heart, lungs, abdomen daily.
- D. Ward notes - are handwritten on templates from the same ICU computer. Incoming on call person rounds on the ward. When pre-rounding on the ward, at least speak to each patient and ask if any problems overnight, confirm with the overnight nurse and examine as indicated by history.
- E. Consults - Call consults and write DC orders early in the day.
- F. Discharges - Write prescriptions and have clerk send to pharmacy the day before if possible. To be discharged a patient must:

1. Have a stable wound.
2. Have someone trained to take care of their wound.

3. Have resolved needs for inpatient therapy or nutritional support.

4. Be able to tolerate previous with simple, modest narcotics.

G. OR booking - Remind the senior to book OR time before 10:00 AM today, for the next day's OR time block.

H. Wound exam - Every burn wound should be seen by a physician daily. 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.

I. Burn and Wound Diagram - Please fill out upon admit and after any OR procedure. See **Appendix for admit burn diagram**.

J. HIPAA patient confidentiality is in effect for all patients. However, patients with special issues will have a blue card on their door to alert us to go to the nursing kardex for further information.

BURN PATIENT EVALUATION

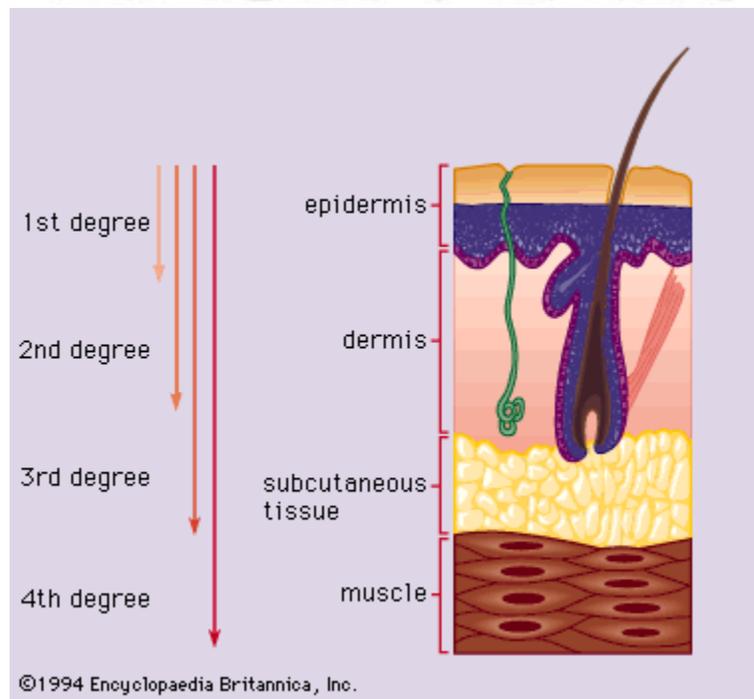
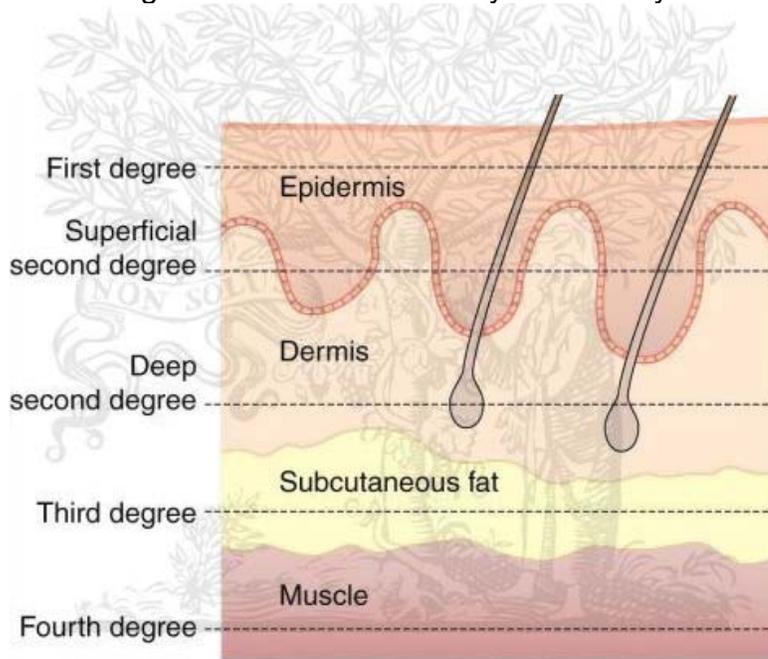
A. ABC's

1. Airway and C-spine control - Check for smoke inhalation
2. Breathing and oxygenation - CO poisoning
3. Circulation - IV access, start warm LR resuscitation, and check circumferential burns for the need for escharotomies.
4. Disability/ neuro exam - Level of consciousness (awake, alert, oriented), pupils, Glasgow Coma Score.
5. Exposure - For complete wound exam, remember to turn patient. However, it is very important to cover patient afterwards to AVOID HYPOTHERMIA. Use heat lamp and keep patient room door closed.

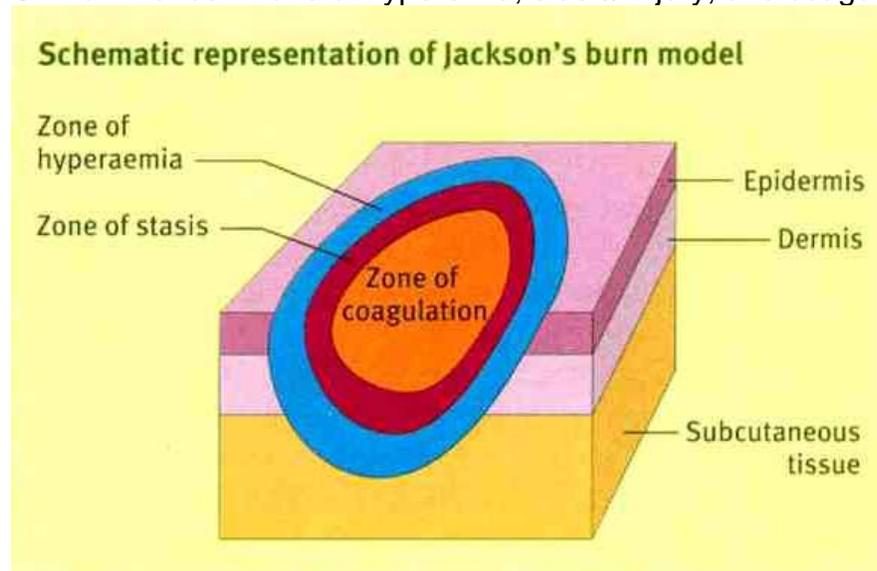
B. Burn depth staging

1. Superficial or 1st degree - Involves epidermis, appears as non-blanchable erythema. Swollen, dry, painful.
2. Superficial partial or 2nd degree - Involves epidermis and partial dermis, appears as painful blister. Edematous, moist.
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.



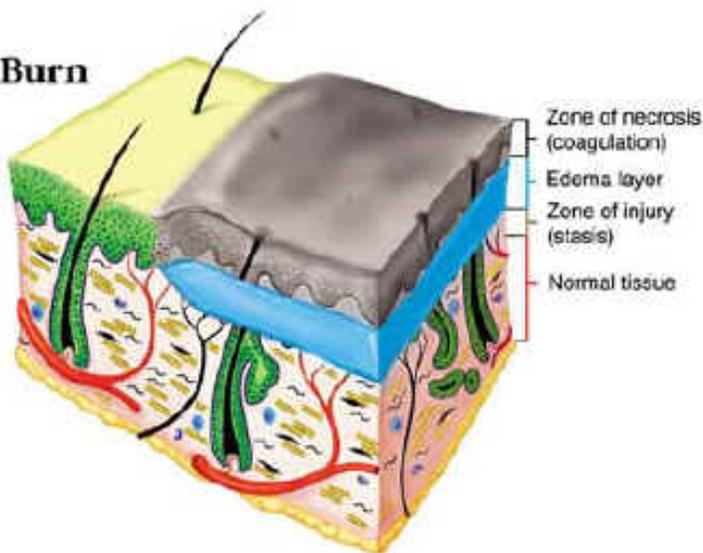
C. Burn zones - Zone of hyperemia, stasis/ injury, and coagulation/ necrosis.



Superficial Dermal Burn

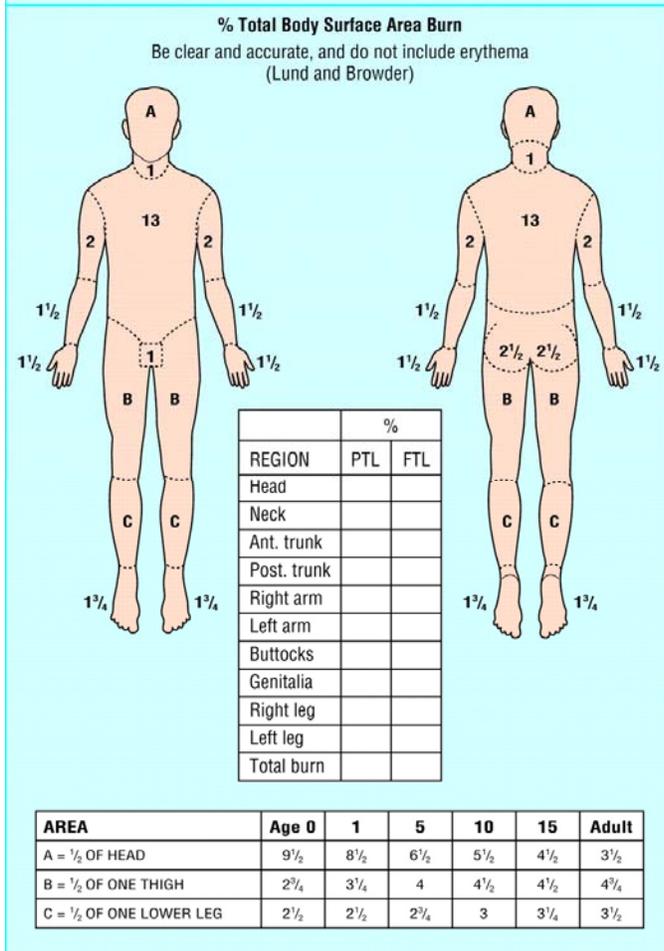
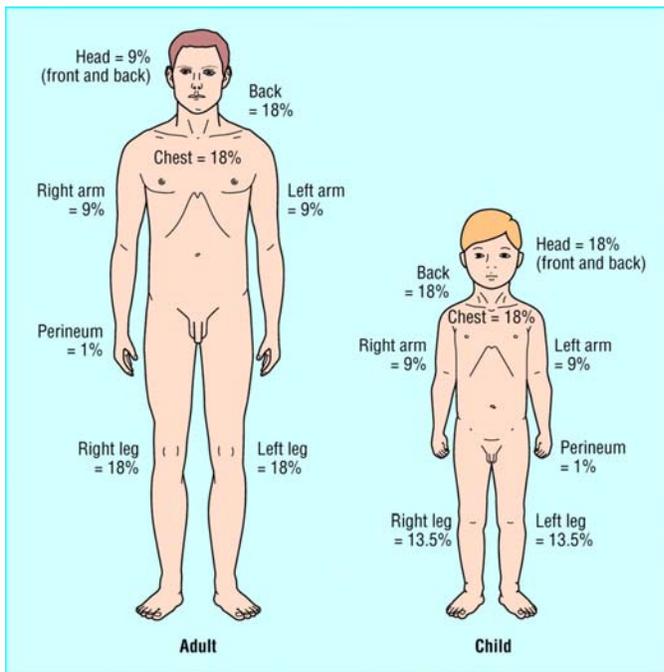
Characteristics

1. Necrosis confined to upper third of dermis
2. Zone of necrosis lifted off viable wound by edema
3. Small zone of injury



D. Burn Area

1. Quantified by total body surface area burned (%TBSA).
2. Use Rule of Nines to "guestimate" burn size. Applies to burns greater than 1st degree. 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)**. See **ADMIT / TRANSFER CRITERIA** below.



E. 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: $4 \text{ ml ringers lactate} \times \% \text{ TBSA burned} \times \text{weight in kg} = \text{total fluid requirement}$ 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.

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

| 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) |

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, vitamin C at 66 mg/kg/hr continuous IV X 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](#).

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.

6. If resuscitation, urine output, is not proceeding as 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.

F. Burn dressing - Decide on a topical treatment and dressing that promotes healing, prevents infection, 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

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 - Acticoat Q 3-5 days, 5% Sulfamylon soak Q 3-5 days.
4. Face wound - Bactroban 1-3 X daily, Aquacel AG and trim off lifted healed portion or change prn weepy from edema.
5. Ear wound - 8.5% Sulfamylon cream QD.
6. Hand wound - See 1-3 above, or Bactroban and xeroform. Elevate on sling or pillow.
7. Diabetic insensate foot wound - 8.5% Sulfamylon cream QD. Encourage pt to walk on it. Elevate foot when at rest.

G. History - Time, cause, circumstances of injury. Smoke inhalation, enclosed space? Any other trauma? Past medical history, meds and allergies. What treatment given so far?

1. Brief history after ABCs, then more detailed history, tetanus and immunization, social history, work history (hand dominance), and review of systems after burn eval and after resuscitation has started.
2. Peds; family / 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.

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

CLINICS

Clinics are in A5B on Monday and Wednesday afternoon, 1:00 PM till finished, usually by 4:00 PM.

24 hour clinic in the C5D inpatient ward for ER patients.

Kaiser clinic in the C5D inpatient ward on Tuesday and Thursday.

A. Initial Evaluation - See above.

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

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

D. 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.

ADMIT / TRANSFER CRITERIA

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

We accept all burn transfers of LA county residents unless there is no nurse or no bed available that day.

Floor admissions should be called to senior. ICU admissions should be called to senior, then attending. See **admit orders in appendices**.

Minor small burns may be treated as outpatients.

Major burns get admitted to ward or ICU.

A. Children and elderly - Admit second-degree or greater burns totaling > 10% TBSA in children < 10 years or adults > 50 years.

B. Adults - Second-degree or greater burns totaling > 15-20% TBSA in children and adults between 10-50 years.

C. More than 5% TBSA third-degree burns.

D. Functional or cosmetic risk to eyes, ears, face, hands, feet, perineum, or major joints.

E. Circumferential burns of chest, abdomen, and extremities. See under ICU PATIENT MANAGEMENT, Skin/ Wounds for abdominal compartment syndrome and escharotomy.

F. Major cellulitis - Such as that in the perineal region or involving a large area.

G. Burn inhalation injury gets admitted to ICU.

H. High-voltage electrical injury gets admitted to ICU. See below ICU PATIENT MANAGEMENT, GU.

I. Significant caustic chemical burns

J. Burns with other major trauma, where the burn poses greatest risk of morbidity mortality

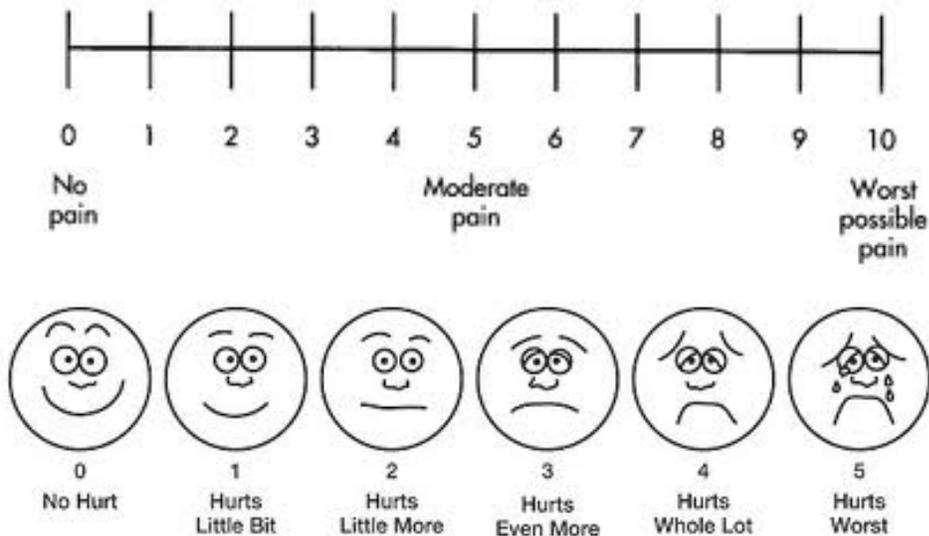
K. Burns with significant medical comorbidities.

L. TEN/ other dermatology conditions - We accept Stevens Johnson/ TEN transfers if diagnosis proven by biopsy and if 20% TBSA or greater involvement.

M. Necrotizing fasciitis / open wounds - We accept decubitus and other open wound transfers 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, they may be better served by the plastics service.

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 out patient. Numerical pain scale of 10 or Wong Baker Faces scale.



B. Nutrition / GI - Start the day of admission. Order prealbumin on Sundays and Wednesdays.

C. PT / OT - OT (face, upper extremity burns) PT (lower extremity burns) consults on most patients. Important for maintaining ROM, managing edema and scars, and recovery and return to independent living

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. We have psychology rounds weekly on Tuesday at 11 AM to help us help the patients cope with the injuries. 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 or dilaudid drip.

The FLACC Pain Scale

| CATEGORIES | SCORING | | |
|---------------|--|---|---|
| | 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 |

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2. MAAS - Daily 6:00 AM SEDATION HOLIDAY and sedation score should be ordered for patients in ICU on sedation drips. Preferred Burn ICU sedation drug is versed gtt or scheduled or IV gtt ativan. Propofol is also good for short procedures such as intubation or bronchoscopy. 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**.

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 - Self explanatory

| | | |
|---------------------|---------------------------------|------|
| | | |
| 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 confused ICU patients at risk of self extubation. **See restraint order sheet.**

B. Resp - After Inhalation injury, the onset of upper airway obstruction from edema can be very rapid. DL all suspects.

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 if you/ the senior are not experienced/ comfortable. 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, 7-7.5 ETT is adequate; for women 6.5-7 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

a) SIMV - Most of you know how to manage this already. Set the rate, tidal volume, PEEP, and pressure support. Check the blood gas and fine tune settings.

b) 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. Joe Escudero will give you a lecture on HFPV. Basically, set the respiratory rate/ percussions, peep/ CPAP, and PIP at 15/500 2/10 and 20 respectively to start. Adjust the CPAP for oxygenation and adjust the PIP for ventilation. See [VDR set-up, VDR MANAGEMENT pocket card, Weaning Protocol](#).

5. FiO₂ - Do not turn FiO₂ up higher than 25% for most patients, 30% for very sick patients. ABG with pO₂ in the 80's or greater is adequate.

6. Inhalation injury - Smoke inhalation causes injury in 3 different ways. CO poisoning occurs during and immediately after exposure. Upper airway swelling happens within minutes to hours after exposure. Parenchymal lung injury from toxic by products of combustion occurs within hours to days after exposure.

a) 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.

b) 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](#).

7. Weaning/ extubation - Patient must have good cuff leak before extubation. Spontaneous breathing trial is considered the best weaning trial in burn ICU. For chronically ventilated patients, this may not be possible, so we have to wean the PIP and CPAP slowly, about one small step each day, and wait for the patient to adjust or show us that they are decompensating and suffering increased atelectasis. Be sure the cuff is completely deflated for spontaneous breathing trial. In order to wean/ extubate successfully, patient should be alert, hemodynamically stable, have good cuff leak and good oxygenation, be able to cough forcefully, and does not need major surgery in the near future. Notify the senior or attending before extubating, and it's wise to be present in the patient room or in front of the room for the extubation, in case something goes wrong.

8. 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 vent associated pneumonia. Drs Garner and Nabavian do their own trach with you for the more straight forward patients. Call ENT for difficult morbidly obese patients with thick short necks. The trach can be down sized after 3-4 weeks if no more surgeries are needed and patient has been stable on trach shield on humidified air. Standard trachs are in supply cart, secret stash of special trachs are in bronch store room.

9. Decannulation - Criteria include no more airway swelling, good oxygenation, minimal secretions, ability to cough to clear secretions and protect airway, no more surgeries needed. Patient can also be decannulated in clinic after discharge.

1. Monitoring - Swan, SVO2, CVP, pulse, BP, daily wt

a) A Swan Ganz pulmonary artery catheter is ideal 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 the oxygen is extracted. Other valuable information include the CI which tells you how hard the heart is working and compensating for the burn and related complications, and the SVR/ SVRI which tells you the status of vascular tone or vasodilatation.

b) A CVP from a central line is adequate for determining volume status and filling pressure for most straight forward patients.

c) Daily weight is surprisingly useful in burn patients because they have huge insensible loss. 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, and usually the diastolic pressure will drop and pulse pressure widen before the systolic pressure or MAP drops.

2. Pressors, inotropes - Except for dopamine, initiation or titration of vasopressors should be guided by a PA catheter and SVO2 measurements during the first days of pressor use. We do not use pressors in place of resuscitation so beware of pressors early in resuscitation.

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.

b) Phenylephrine and vasopressin can also be used. Phenylephrine is used as an alpha agonist.

c) Vasopressin is effective as repletion of low endogenous vasopressin levels in sepsis, and decreasing the total amount of levophed needed to maintain MAP.

d) Be wary of pressor induced ischemic bowel.

3. Arrhythmias

a) Atrial fibrillation should be worked up for correctable causes such as electrolyte depletion, volume depletion. Acutely, it can be rate controlled with amiodarone gtt, beta blocker gtt, or diltiazem gtt. We can consult cards as well. If patient has more than one episode of afib, will need to stay on amio for extended time. Cardioversion is ideal for patient survival outcomes.

b) Sinus tach - Burn patients have ST from pain, inadequate resuscitation, or hyper metabolism from SIRS, treat according to cause.

c) Beta blockade is good for ST from SIRS. Preferred drugs are metoprolol for adults, propranolol for children.

4. Diuretics - Do not give lasix, aldactone, HCTZ without attending approval. Diamox is allowed, especially in vented patients with metabolic alkalosis and adequate volume status.

D. FENutrition / GI

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. K, Mag, Phos, Na - Replace lytes so that K = 4, Mag = 2, Phos = 4 or thereabouts. Give free water with Resource tube feeds (concentrated formula) if patient is hypernatremic.

3. Ulcer prophylaxis, GIB - GI prophylaxis (Protonix) on everyone not fed via stomach and on everyone critically ill.

4. Feeding starts on the day of admission because of hypermetabolism and hypercatabolism, 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. Order PAB and CRP on Sundays and Wednesdays.

a) Curreri formula - Adult

$25\text{kcal} \times \text{weight (kg)} + 40 \text{ kcal} \times \% \text{BSA burned}$

b) Hildreth + Associates - Child under 1 year of age

$2100 \text{ kcal/m}^2 \text{ BSA/day} + 100 \text{ kcal/m}^2 \text{ burned/day}$

5. NG tube in intubated patients, in patients unable to eat their required protein and calories to maintain goal PAB, and in patients 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. Promix 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 used in collagen hydroxylation, tissue regeneration. Zinc promotes protein synthesis. Glutamine good for enterocytes. Oxandrolone helps prevent loss of muscle mass.

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

10. PEG - Rarely indicated unless patient will still not be able to eat after burn issues are resolved.

11. Abdominal compartment syndrome (ACS) - Can be caused by over resuscitation with circumferential abdominal burn eschar; high transmitted intra thoracic pressure from ventilator; obesity; abdominal surgery and bowel edema; ascites; constipation, ileus, obstruction, or other GI stasis problems with ongoing tube feeds and full distended bowel. See [Abdominal Compartment Syndrome protocol](#)

a) Intra abdominal hypertension is defined as intra abdominal/ bladder pressures >12 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.

12. Ogilvie's - Prevent it with electrolyte repletion, bowel regimen, and attention to GI function. See [Neostigmine guidelines](#) for GI stimulation.

E. 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.

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. Lower grade fever without other signs or symptoms of infection most likely 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 sick and septic and all cultures are already pending. Be aware of MDR Acinetobacter 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 preferred 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, because hospital acquired infections is so easily preventable by conscientious doctors and nurses, and because the hospital keeps stats of such things for quality control and comparison to other units and other hospitals.

F. 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, 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.
3. ARF - Usually due to inadequate perfusion from inadequate resuscitation, or impending sepsis and vasodilation. FENA, FE Urea, 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.

G. Endocrine

1. DM glucose control - Glucose goal is an average of 150 or less (range 90-150) for optimal wound healing. When patient not on tube feed, may be able to control with diet alone. Patients who are consistently out of control need to transfer to ICU for insulin drip, especially immediately after surgery. Once more stable, can convert to tid insulin plus ISS. See insulin [gtt and insulin SS order sheets](#).
2. Anabolic steroid - Steroids hinders wound healing in general. However, 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.
3. Steroid deficiency - For trauma induced deficiency, hydrocortisone is good as replacement therapy because of relatively stronger mineralocorticoid versus glucocorticoid effect.

H. Lines - IV access is a high priority during initial admission and resuscitation.

1. 3LC, cordis, Swan - Sterile procedure. Get line consent and gown, glove, mask appropriately. Most important thing to remember about floating a Swan is advance with balloon up and withdraw with balloon down. The assisting nurse will flush the ports, test the balloon, and zero the waveform before you start.
2. A-line - Sterile procedure. Needed for frequent blood gas monitoring.

3. Dialysis access - IJ or femoral are good sites. IJ lines should ideally be done with ultrasound guidance.

I. Skin / Wounds - When dressings are open see as many wounds as you can daily.

1. Burn dressing preop - Most patients with clean superficial wounds can be put in Mepilex silver impregnated foam dressing. See **Burn Center Dressing Order Form**.

2. Burn dressing postop - Most patients with meshed grafts will be in 5% Sulfamylon soaked burn dressing. See **Burn Center Dressing Order Form**

3. Abdominal compartment syndrome - Paralysis is useful for obtaining accurate intra-abdominal pressure and good for extemporizing in ACS. It is not good therapy for ACS because it does not treat the cause. Find the cause of ACS and treat accordingly.

4. Escharotomy - For compartment syndrome from circumferential burns and over resuscitation/ edema. Remember, loss of pulse is a very late sign of compartment. Other signs are distal cyanosis, pain, paresthesia, decrease in pulses, 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, incising 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**.

5. Quant cultures - Send approx 1 gram of tissue in a test tube with no solution or preservative. The nurse will tube it to micro for you, but be sure to call micro to verify that they received specimen and process it in a timely manner, before it is dried out.

6. 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.

7. Decubs

a) Relieve pressure - Use a low air loss bed, and frequent turning schedule by RN

b) Stage the wound

(1) Superficial or stage I - Involves epidermis, appears as non-blanchable erythema

(2) Superficial partial or stage II - Involves epidermis and partial dermis, appears as painful blister

(3) Deep partial or stage III - Involves epidermis, dermis, and sub Q

(4) Full thickness wound or stage IV - Involves epidermis, dermis, sub Q, possibly muscle, tendon, bone

(5) Unstageable - Wound is usually covered by eschar

c) Decide on a topical treatment and dressing that promotes healing, prevents infection, and protects deeper tissues.

(1) Superficial wound with healthy tissues; Mepilex

(2) Deeper wound, necrotic tissue, need for daily debridement; Silvadene 1% cream, Sulfamylon 10% cream or 5% soak,

(3) Deeper wound, healthy, no need for daily dressing: Acticoat, Aquacel AG.

d) Ensure adequate nutrition by providing adequate calories and sufficient protein to normalize prealbumin > 15.

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

f) Debride - Can locally debride small areas of necrotic tissue at bedside as tolerated. Debride more aggressively as needed in the OR.

g) Surgical closure of wound in the OR - Wound should be clean with less than 10^5 colonies per gram from a quantitative wound culture. Patient should have adequate nutrition as proven by normal prealbumin. Options include primary or secondary closure, split thickness skin graft, and local or free flap.

J. Musculoskeletal - See above under WARD PATIENT MANAGEMENT.

K. Psychosocial - See above under WARD PATIENT MANAGEMENT.

OR

Go to surgery whenever not on call or floor work not too busy. One resident R2 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.

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. Operations on excessive areas of the body 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.

- A. Antibiotics - Peri-op antibiotics should be continued for 24 hours for sick or chronic patients.
- B. Position - Plan for access to your donor sites as well as debridement sites.
- C. Prep, drape - Don't forget to shave the donor sites before the nurse preps the patient.
- D. Transfusions - See under ICU PATIENT MANAGEMENT > Heme / ID
- E. Debridement - There will be little bleeding if you have injected tumescent solution, watch for shiny healthy fat and tissues instead.
- F. Harvesting - Split thickness for most grafts, full thickness for when you are trying to minimize contractures. Meshed graft for everywhere except face, neck, and hands.
- G. 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 same after you finished securing graft. Otherwise check grafts on POD 5-6.
- H. Integra, cadaveric - Integra acellular bovine dermal matrix can be used to help cover large burns, but it tends to get infected and purulent under the outer silicone layer, so be on the lookout and trim away the silicone layer when this occurs. We don't use cadaveric skin; it is predictably rejected by the body.
- I. Splints - Splint grafts that cross or are near joints. OT/ PT will often come to OR to wrap Coban or apply splints for us.
- J. Post op orders - Don't forget to order irrigation if you placed red rubbers in the dressings. Also fill out the burn **dressing diagram**.
- K. 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.
- L. Family Communication - Senior resident or fellow should talk to family after surgery.
- M. 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.

APPENDICES

MAC form

Admit orders

Admit burn diagrams adult and peds

*Ascorbic acid protocol

*Ascorbic acid infusion rate flow chart

*Order form_Burn Center Pain Management

*Overview of Burn Pain Management

*Adult Burn ICU Sedation Guidelines

*Haloperidol (IV) Protocol

*ETOH withdrawal protocol

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 patients