

BURN INJURY

Annual Incidence and Prevention

1,000,000 burns occur yearly in the U.S, and about half of these are treated. In fact, only 5% result in hospitalization. The most predominate type of burn is a “scald”. The takehome message is th the vast majority of burns are minor, requiring little or no treatment.

Some tidbits about burn and possible methods of prevention:

- Smoke inhalation is the primary problem with mortality, people need to know to drop and crawl!
- Motor vehicle accidents often end in collisions and explosions (speed limits help prevent?)
- Smoking and drinking together—catch on fire. People light up and then pass out. Not a good combo!
- Mental health intervention (many mentally ill try to end their life with fire. Tom was called to a scene where the guy doused himself with lighter fluid and then lit himself on fire in front of his family. He had burns on over 80% of his body and I don't think he made it. They had to come get him with a helicopter and fly him to UCD.
- Water heater limits are good for preventing burns
- Ensure smoke alarms are operational
- Cool the burn until it is normal body temperature.
- Public service projects are really important to let people know what to do in case of a fire: Stop, drop and roll; crawling under smoke
- Illegal activities: meth labs (they tend to explode I think)
- Know exits in the home...have a fire plan!

ON-THE-JOB BURN PREVENTION

- Observe and assist the challenged
- Report defective equipment
- Be wary of oxygen
- Handle chemicals respectfully
- Remember R.A.C.E. acronym (Remove, Activate Alarm, Control (I think that means close doors), Extinguish

What exactly is a burn?

BURN = Alteration in Skin Integrity. Can be heat, acid, alkaline (chemical)

STOCK DEFINITION - “injury to the tissues of the body caused by heat, chemicals, electrical current, or radiation”

ALSO INCLUDES: Road burn, Degloving injury , Frostbite, Cool smoke inhalation, TENS, Stevens-Johnson

Dr. Sutherland proposes a better definition and says “Is a burn unit really an injured skin unit?”

Consider: skin, heat/cold, injury/removal, gravity, treatment

Burn Occurrence

- Burn occurrence is “trimodal”, this means there are three peaks (ages) when burns are more likely to occur.
 - Children 1-5
 - Risk-taking males age 18-35
 - Adults 60 +
- Gender Distribution
 - 2 boys: 1 girl
 - Possible reason is that parents are less cautious with male children
- Mortality Rate
 - Up to 12,000 die yearly in the United States from burns.
 - Mortality is highest in elders.

Burn Assessment

Why do you need to estimate TBSA? Treatment decisions are based on this. It tells you where to treat, whether to treat, fluid resuscitation needs, estimating length of stay, strategizing NG (what on earth does that mean?)

Burn Size: Burn size is expressed as a percentage of TBSA. The **Rule of Nines** was introduced in the 1940s as a quick assessment tool for estimating burn size in an adult. The basis of the rule is that the body is divided into nine anatomic sections, each of which represents 9% (or a multiple of 9%) of the TBSA. Note that the extent of burn injury is most accurate after the initial debridement, and should therefore be verified again at that time.

Burn Location: The location of the injury can affect outcome.

- Pulmonary complications occur with burns to the head, neck and chest.
- Burns of the face often occur with corneal abrasions
- Burns of the ear are susceptible to infection and further loss of tissue
- Burns of hands/joints requires intense PT and OT; may lead to permanent vocational disability
- Burns of the peri area are susceptible to infection
- Circumferential burns of the extremities can have a tourniquet-like effect which can lead to distal vascular compromise
- Circumferential burns of the thorax may lead to inadequate chest wall expansion and pulmonary insufficiency.

Age: The pt's age affects severity and outcome. Death rates are higher for children under 4 and adults over 65.

General Health: The pt's overall health will influence their response to injury and treatment.

- Death rate for pt's with cardiac disorders is 3.5-4x higher
- Pts with alcoholism have a three-fold increase in mortality; those who survive have ↑ LOS and more complications
- Obese pts are at increased risk b/c of cardiopulmonary complications

Severity of the Burn

- First degree - sunburn
- Second degree - probably blisters - epidermal injury, some dermal
- Third degree - deep dermal injury
- Fourth degree - treat as deep third-degree burn
- Now we call these first-degree, partial thickness and full thickness
- When gathering initial data about a burn, we want to know what it looks like (ask about blisters) and where located.

Histological Assessment (*not in lecture, but she mentions "zone of stasis" so it's explained here*)

- Zone of coagulation: comprised of the surface tissue necrosis of the initial burn eschar. The surface injury is caused mainly by the heat or chemical insult. This is irreversible injury.
- Zone of stasis/injury: Deep and peripheral to the zone of coagulation, there is a sizeable area of tissue injury where cells are viable but can be easily be damaged further. This zone is most prominent in mid-to-deep dermal burns where there is less blood flow.
- Zone of hyperemia: Peripheral to and below the zone of stasis is the zone of hyperemia. The area is characterized by minimal cell injury but with vasodilation due to neighboring inflammation-induced mediators. Complete recovery of this tissue is expected unless there is additional severe insult such as an invasive infection or profound tissue inflammation.

First Aid for Burns

- Remove from the source of burning.
- Call for treatment or guidance...can take care of small burns on your own.
- If significant, cover with a clean cloth, elevate, and transport.
- If minor, wash and cover with Bacitracin.
- CHICKEN SOUP RULE: Xeroform = SSD = Bacitracin (So the rule is to keep it covered with something, I think all were equally effective on the guy who burned himself with soup. She's hard to follow)

Structure and Functions of the Skin

Keeps your insides in

- Fluids
- Electrolytes
- Protein
- Appearance
- Heat

Keeps the outside out (most people get infected with what is already ON the skin)

- Bacteria
- Yeasts and fungi

Skin Layers

- Epidermis (superficial). When they remove skin they take just the epidermis mostly.
- Entire epidermis and some dermis (partial thickness)
- Dermis (deep partial thickness); entire dermis (full thick)
- Fat, muscle bone (deep full thickness)

2nd degree burns are leaky...lose albumin which is bad, affects BP (and probably other things, too!)

Pathophysiology of Burns (not in lecture)

- Introduction
 - In burns over 25% of TBSA, the body's response to injury is systemic and proportional to the extent of the injury.
 - The clinical manifestations of an extensive burn present in a dramatic fashion over the course of treatment
 - Extensive burns affect all major systems of the body
 - The systemic response is typically characterized by early hypofunction and later hyperfunction of each organ system.
- Direct Injury to the Skin
 - Amount of damage depends on length of exposure and temp
 - Various cellular systems fail with sustained heat
 - Sodium-potassium pump fails → cellular edema
 - As temps rise to 44°C, cell necrosis occurs
 - Free radicals are produced → further cell damage
 - This process continues until heat source is removed and cooling mechanisms return
- Fluid Shifts
 - Immediately following burn injury, vasoactive substances are released from injured tissues.
 - Capillaries become "leaky", allowing plasma to seep into surrounding tissues
 - Direct damage to vessels also leads to capillary permeability, which permits sodium ions to enter the cell and potassium ions to exit.
 - This overall effect is the creation of an osmotic gradient that leads to increases in intercellular and interstitial fluid → further depletion of vascular fluid volume.
 - Thus, the pt's hemodynamic balance, metabolism and immune status are altered.
 - Body responds initially by shunting blood toward brain and heart → prolonged lack of blood flow to other organs. If fluid resuscitation is delayed, hypovolemia progresses and acute renal failure may occur.
 - After resuscitation, the body begins to reabsorb the edema fluid and eliminate it through diuresis.
 - Blood flow to mesenteric bed is also diminished initially → intestinal ileus and GI dysfunction (if burn > 25%) → small, superficial erosions to stomach and duodenum → ulcerations and gastric bleeding if not treated.
- Pulmonary System
 - Initially, minute volume is unchanged or slightly decreased
 - Following fluid resuscitation, an increase in minute ventilation may occur (especially if fearful, anxious, in pain).
 - Is the result of ↑ RR and tidal volume, and appears to be a result of the hypermetabolism mentioned earlier.
 - Typically peaks in second post-injury week and then gradually returns to normal as the burn wound heals or is closed by grafting.
 - Pulmonary vascular resistance may increase slightly and lung compliance may decrease → increased WOB (but usually don't require treatment)
 - Inhalation Injury

- The most common cause of early mortality d/t inhalation injury is exposure to asphyxiants (CO)
- Direct heat injury to upper airway results from inhalation of the heated air → heat produces injury to the airway → edema, erythema, ulceration (ouch!). Thermal burns to lower airway are rare but can occur with inhalation of steam or explosive gas, or aspiration of scalding liquid.
- Smoke poisoning results from inhalation of by-products of combustion → localized inflammatory reaction, a decrease in bronchial ciliary action, and a decrease in surfactant. Mucosal edema occludes small airways. ARDS can occur.
- Myocardial Depression
 - Significant and immediate depression in cardiac output occurs even before circulating plasma levels decrease (may be a neurogenic response)
 - Depression in cardiac output often continues for several days even after plasma volume levels have been restored and urinary output normalizes.
- Altered Skin Integrity
 - Most important loss is the skin's barrier function.
 - Mechanisms for maintaining normal body temp are altered
 - Risk of infection increases
 - Evaporative water loss increases
 - Nerve endings can be exposed or damaged
 - Hypertrophic scarring can occur in severe injuries. This is the reddened, raised, rigid and uncomfortable scar. They often itch and are very sensitive. They can result in skin and joint contractures, especially when the scar crosses over a joint.
- Immunosuppression
 - Immune fxn is depressed d/t:
 - depression of lymphocyte activity
 - decrease in immunoglobulin production
 - suppression of complement activity
 - alteration in neutrophil and macrophage function
 - Primary barrier is altered (see above)
 - There is a risk of life-threatening sepsis
- Psychological Response
 - Responses range from fear to psychosis
 - Response is influenced by age, personality, cultural background, impact on body image, etc...

Treatment Decisions

Where to treat

- Burn unit
 - greater than 10% burn
 - involvement of face, hands, feet
 - smoke inhalation
 - comorbidities affecting healing
- Local hospital
 - initial ER treatment, limited grafting
- Home Treatment
 - less than 10% burn (or slightly more)
 - responsible caregiver present
 - pain able to be managed
 - pt tolerating oral fluids (if throwing up a lot, they' re not going to be able to take in oral fluids).

Whether to Treat At All

- Mortality rate is roughly calculated at TBSA plus age. Comorbidities increase this sum. (see above)
- A sixty-year-old with a 35% TBSA injury has a 5% chance of survival.
- As your percentage burn increases, the survival decreases.

Comfort Care Only (not seeking a cure)

- Decision made to not seek cure for **sums of 120 or greater**, if smoke inhalation is present or if comorbidities exist
- May be made for sums of less than 120 with devastating smoke inhalation and cerebral hypoxia

Degrees of Support

- Comfort care
- DNR (but still doing active treatment)
- No compressions (modified DNR)
- “Everything but dialysis”

Intubation Criteria...when do we put in a tube?

- Burns of the face and neck
- Greater than 40% TBSA...sooner is better than later, so get it in while you can.
- Smoke inhalation, with actual or potential respiratory distress
- Actual respiratory distress without smoke inhalation

Smoke Inhalation Diagnostic Indicators

- Blackened, burned nasal hair
- Soot in the mouth or nostrils
- Stridor, wheezing, progressive hoarseness
- Check O2 sats and RR...part of the whole picture if we need to intubate.

How Much Fluid to Give?

- If pt is able to swallow, give them cool fluids and tell them not to talk
- Give enough to support perfusion (Why support perfusion? Why not just put back what fell out?)
- Trying to put fluid into vascular compartment.
- We need to know their weight so we can do the calculation
- Calculation of burn resuscitation fluids
 - Body weight in **kg x TBSA x 4ml/hr of LR** (LR b/c burns leak plasma components: water, protein, sodium...LR is close to plasma in its makeup)
 - Administer half in the first 8 hours (from time of burn)
 - Administer remainder over the next 16 hours.

Calculation Example

- Adult male, 198 pounds, with burns of both arms, left total leg, half of the right leg, half of the back, and genitalia.
- Calculate hourly IV rate
- He weighs 90 kg
- Percentage of burn = 55%
- $90 \times 55 \times 4 \text{ml/hr} = 19,800 \text{ ml}$ (round up to 20 Liters)
- Give HALF in the first 8 hours ($10,000 \text{ml} / 8 \text{ hours} = 1,250 \text{ ml/hour}$).
- This seems like a lot, so you start with that for the first hour, then check urine output one hour later. Titrate accordingly.

The Other Part of the Formula (*though she doesn't tell us how to titrate/adjust!*)

- Titrate to hourly urine output of 0.5 ml per kg per hour.
- Burns over 20% TBSA need Foley catheters.
- Don't judge by edema (a cosmetic problem in the burn patient, nothing else) or fluid totals. Judge by perfusion.
- Contrary to some texts, don't treat the lab values (such as H&H).
- Monitor electrolytes and treat only what is deficient. Mainly replace a lot of Calcium in first 24, sometimes Mg. It just depends on the person.

Destruction Vs. Impaired Perfusion

I think what Dr. S was getting at here is that the tissue can either be damaged by the burn or damaged d/t inadequate perfusion. We need to assess carefully to understand the difference and also make sure that we do smart fluid

resuscitation, elevate the burned area, oxygenate and put the pt into proper alignment. One way to measure perfusion is via Foley cath, so I'm pretty sure they'll all get a cath. Also, when it comes to calculating resuscitation needs, you also have to take into account smoke, alcohol use, meth and dryness...these will all increase fluid needs. NOTE that overhydration can distend the zone of hyperemesis and create pressure that kills injured cells in the zone of stasis.

So....when you're working in the ER, don't forget...

- Pain management by IV (no IM b/c they may not be perfusing well and it would just sit there)
- Tetanus shot (this is not something you have to do that moment...have a window of 2-3 days)
- Elevation of burned extremities (very important...get above heart level b/c they swell like crazy, creating pressure on the cells...also less painful)
- No antibiotics, no wound care (BU has to undo dressing...it's painful...just cover it with sterile towel/sheet.
- Get their contact person's name and phone number (get it early b/c pain meds will affect ability to recall info)
- Ask about pre-existent conditions and illnesses (be sure to ask about early, before pain meds kick in)
- Ask about allergies
- Stop burning:
 - remove smoldering or wet/scalded clothing, cover pt with a dry sheet and blanket to preserve heat
 - if chemical burn, remove clothing, brush any chemical powder off skin, irrigate continuously with lots of water for at least 20 minutes and until burning sensation stops. Neutralizing agents are not recommended (they can cause further tissue damage)
 - for chemical eye injuries, irrigate eyes with gentle stream of NS from the inner canthus outward
- Two large bore IVs
- Sedation and intubation (if warranted, I'm not sure intubation always is)
- Elevate injured extremities 15-degrees above level of the heart; assess distal pulses often

The 2nd 24 Hours

- After 24 to 36 hours, diuresis begins.
- Colloids are given (25% albumin at 10 ml/hr)
- Decrease the fluids to "burn maintenance." (which is more than regular maintenance...there is a formula for this and it is ~ 200/hr)
- Monitor potassium, it will start falling off d/t diuresis. Sodium may or may not fall.
- Glucose may be high with a brain injury (and I have no idea why)

When to use NG/Feeding Tube

- Before IVs were used, burn injury greater than 30% was usually lethal. Burn injury greater than 20% was near the limit of survival in middle-aged adults. I guess they weren't able to eat or take in fluids?
- The vascular compartment empties, and the gut shuts down. Often you don't have very good bowel sounds and people are persistently vomiting...dehydration used to be the main reason people died.
- If you can do trickle feeds, this will keep the gut happy and it keeps the gut flora happy which means they'll stay in the gut and not go looking for trouble.
- The intubated patient needs a Salem sump for decompression, because emesis may hazard the airway.
- A patient with greater than 20% burns needs a Salem sump for repeated emesis and needs a feeding tube for nutrition if unable to meet calorie and protein goals by mouth after a few days' trial.

What Different Burns Look Like

- First degree - a sunburn without blisters
- Second degree - "partial" - usually pale pink to pink with blisters. OK to pop blister if it is impeding movement, but wear a face shield; 2 weeks to heal; No ER care necessary
- Deep partial - pink to red, with some white or tan patches, blisters rare, mod edema, pain, soft and dry eschar; 2-6 weeks to heal
- Third degree - "full" - white, cream, brown or black eschar, diminished surface sensation
 - Black, no blisters, absent pain in deep full burn, severe pain in full burn; weeks to months to heal
 - Wait on frost bite b/c it often is better than what it looks like; electricity to treat?
 - Exit wound from electrical burn; tendency is to graft them, but it is best to wait b/c it may be more damaged than it appears.

Treatment and Rehabilitation (concurrent).

Initial Burn Assessment

- Calculation of TBSA
- Decision on sending pt home versus admission
- Some decision about the potential for grafting, even if an outpatient

Outpatient Wound Care

- "Clean is good, sterile is better." We think we're doing sterile dressing changes...but in reality they are "pretty clean". Teach pt that they need to wash 1-2x a day and put topical on it.
- In regards to activity: "The more you do, the better." (don't stand on a foot burn though!)
- Teach pt the signs of infection. (elevated temp, more painful, or feel worse)
- Teach pt to take temp once a day
- "Don't let your face dry out." (if a face burn)...give them bacitracin and make sure it stays covered. bacitracin itches.
- "Return to clinic in...." give them an appointment to make sure they'll be seen
- Teaching and supplies...how to wash, put on bacitracin. give supplies. teach about elevation.

Inpatient Burn Treatment

- Burn unit treatment
 - support of all body systems
 - twice-daily dressing changes by nurse (patient may assist)
 - possible grafting
 - physical/occupational therapy

Major Burn Injury

- A major burn injury impacts every system of the body, and sometimes treatment of one system affects a different one adversely.
- Pain and anxiety medications administered in large quantities can cause respiratory depression, but they are essential for wound care.
- After initial resuscitation, boluses for hypotension and decreased urine output may cause pulmonary edema.

Emergent Phase Goals (24-72 hours after the burn)

- Patient's fluid rate at burn maintenance and urine output at least 1/2 cc per kg per hour.
- Vital signs stable.
- Hemoglobin WNL.
- Diuresis of resuscitation fluids.
- Respiratory status stable.
- Wound care pattern initiated.

Acute Phase Goals (extends from emergent phase until wound is closed via secondary intention or skin grafting)

- Wounds closed or closing
- Pain controlled with oral medications except for wound care
- Passive participation in occupational and physical therapy
- Nutrition goals met orally
- No mechanical respiratory support

Rehabilitation Phase Goals (from time of graft adherence or wound closure until scar has matured)

- Patient responsible for skin care, nutrition, active range of motion.
- Patient formulates own plan for the near and distant future, relative to relationships, work and avocations.

Modern Burn Care: Ongoing Fluid Management (Pseudoresuscitation...I couldn't find this term anywhere)

"Pseudoresuscitation"

- Resuscitation completion
- Diuresis
- Early excision and grafting - operative and postoperative fluid fluctuations
- Transfusion only for Hemoglobin below 7 in the asymptomatic

- Older patients with comorbidities
- Discharge meaning, “out of the woods”

Acute and Rehabilitation a Dual Focus From Admission

- Prevention of infection (glove and gowns every time in room)
- Nutrition and digestion (eat as much as possible...pt will heal faster)
- Unburned skin integrity (don't cause more problems, turn pts, get elbows off bed, think about heels and put pillows under the calves)
- Maximum range and function (encourage pt to do as much as they can...they need to MOVE!)
 - Neutral positioning with minimal flexion to prevent contractures
- Mental health: patient and family (people have a lot of regret, feel like they were “stupid”)
- Teaching: patient and family (tell pt what you are doing r/t care, teach about aftercare)

Continuing Themes (*I have no idea what she means by this...things to always be considering?*)

- Pain management (Methadone is a long long acting opioid, lots of percocet q4, trying to avoid IV opioids when you can but may use for big big burns, now use PCAs for burn care)
- Wound care (schedule based on how many nurses it takes, may take pt preference into account. Start with Thermazine or SSD...as burns heal more go to xeroform bandage. Burns heal from the outside in, so this will determine the bandage. Related to grafts, they are soaked for about 5 days to keep moist (not dripping wet though)
- Fluids and lytes (is the person hydrated, what are the labs?)
- Preventive and curative pulmonary (preventative is IS, turning side-to-side, sitting up in a chair, walking) Curative is r/t ventilation
- Collaborating with the burn team (nutritionist, pulmonary, etc...)
- Prevention of cross-contamination (very important...gowns/gloves...cleaning)

Common Problems and Interventions

Neurosensory

- Pain and anxiety, nerve endings (Nerve endings grow back and burn becomes MORE painful)
- Functional grieving - life change (pt has to re-assess)
- Side effects of medications (always look at this...morphine pt will have dreams interspersed with reality...if on Versed or any of the benzos they are going to have holes in their memory, especially with Ativan...reassure pt that they are not losing their noodle)
- ICU psychosis - lack of sleep, noise (try to keep quiet at night so they can sleep)
- Flashbacks are common; dreams about the injury are also common
- Traumatic (current stress) versus post-traumatic (what already happened)
- Premorbid psychopathology (people who are depressed prior will still be depressed...though pts that are electrocuted are often “fine”...maybe like ECT?)

Pulmonary

- Inhalation Injury
 - Grey or sooty secretions (indicate inhalation)
 - Pulmonary lavage early (get the stuff out!)
 - Mucus plugs, collapses
 - Tube integrity (very important!...Tube went down when pt was beginning to have edema...want the tube to stay in there b/c it may not be able to go back in d/t increasing edema...tube security very important! In burn pt, you measure tube at the teeth/gums, not at the lip)
 - Strongly associated with mortality
 - ARDS - PEEP will be higher (around 10-14)
 - Pulmonary edema happens to people who have cardiac problems and are fluid overloaded, can also occur just d/t burn injury
- Compromised Airway
 - Absolute tube integrity
 - Securing the ET tube
 - Recording tube placement R/T...

- Diuresis and its effect on ET tube (may need to loosen ties and tighten them based on diuresis/edema)
- Titrating IV fluids downward
- Minimal pressure, minimal oxygen (now allow “permissive hypercapnia”)
- No E.T. Tube
 - Monitor for increasing stridor, worsening hoarseness
 - Incentive spirometry versus TCDB versus OOB versus ambulate (least to most valuable)
 - Oximetry + breath sounds will drive treatment
 - Mobilization of secretions - dry oxygen in O.R. and E.R.

Cardiovascular

- Resuscitation Phase
 - Absolutely dependable IV access is VITAL...get an unburned extremity if possible
 - IV rate changes, not boluses
 - Titrate fluids at least every hour (titrate to UO...can do more often if indicated)
 - Urine fall before BP fall...so watch urine!
 - Edema is not fluid overload.
 - Albumin, pressors (these help with resuscitation by bringing fluid into vascular space)
 - Feeding tube placement (very important, think of this early...need protein to keep fluid in vascular compartment)
- Critical Phase
 - Absolutely dependable IV access
 - Hypotension and tachycardia treated IV with albumin boluses
 - Albumin drips, nutritional protein
 - Symptomatic anemia before Hgb 7 will get packed RBCs
 - All labs in micro-tubes (you are taking as little blood as possible)
 - Nutritional - feedings at max is the goal
- Post Critical Phase
 - Mild hypotension and tachycardia are expected, don't want rate above 120
 - Low diastolic pressures are to be expected in burns...keep an eye on it.
 - All labs in micro-tubes
 - Iron replacement (most patients will be anemic by the time we're thorough with them)
 - Protein and vitamin supplements
 - IV access not for fluids - Hep Lock only

Gastrointestinal

- Burn > 30%
 - Feeding tube ASAP, keep patent...tend to clot off at low rates, so can also dial in a flush
 - Salem sump for residuals (put in early before edema sets in)
 - Rarely TPN
 - Trickle feeds at about 10ml/hr will keep gut happy, bacteria stay in gut where we want them. Otherwise get bacterial translocation from the gut...so this is why you would give feeds even if gut hypoactive.
 - Postpyloric placement (confirm with x-ray I imagine)
 - Docusate, psyllium, bisacodyl, disimpaction (when taking opioid need to keep stool soft!)
- Burn < 20%
 - Frequent high protein, high calorie nutrition - every 3-4 hours...appetite is often terrible. Give snacks!
 - **Protein is the priority - more is better. Eat protein first, then high calorie stuff...lettuce last**
 - Patient buy-in (ask if they are keeping track of their intake)
 - Nagging and threatening (Reminding is effective....a threat would be show them a feeding tube...scare them?)
- Calories and Protein
 - 25 kcal per kg + 40 kcal per TBSA
 - 20% of calories as protein
 - Example: 90 kg, 55% burn:

With Electrocutation...
 Find both wounds
 Pt on EKG monitor
 Ensure safety

- 2250 + 2200 calories = 4450 calories daily (of which 890 calories are protein)
- protein has 4 calories per gm, so 225 g. protein per day. That's a lot!
- Example: 90 kg, 30% burn:
 - 2250 + 1200 calories = 3450 calories daily, and 690 calories of protein
 - protein has 4 calories per gm, so 125 g. protein

Metabolic

- Electrolyte monitoring
- Glucose goal of 80-120 (working against adrenal glands. may let people get up to 150, then insulin AC & HS...before meals and at bedtime.
- Hypermetabolic response - 38.0 temp (this is expected... if they are a little warm means cells are working hard to replicate and that is a good thing!)
- Slight metabolic acidosis D/T dead tissue and lactic acid buildup
- Calorie and protein goals adjusted as they heal, bring down goals.
- REE for ventilator patients (resting energy expenditure)
- Oxandrolone for larger burns (This is an anabolic steroid given for improved muscle protein metabolism through enhanced protein synthesis efficiency. I love how she just throws this stuff out there and doesn't explain it. I love Googling after lecture...not)

Wound Care

- Initial
 - Devitalized tissue removed
 - Rock-solid IV access
 - Medications incrementally prn (opioids most common now)
 - Topicals per institution (UCD uses Thermazine, SSD)
 - Hair removal is important...burned areas with hair should be shaved to 1-2 inches around edges. Hair follicles trap bacteria
 - Photographs to document wounds, provide a baseline, used for litigation and teaching, to show docs so you don't have to take down dressing every time doc wants to see it.
 - Closed method for body; open for face
- Subsequent
 - Once-daily or twice-daily
 - Enough medication to cleanse and debride (person dependent)
 - Shave face once or twice daily
 - Observe, report and chart s/s infection
 - Cultures prn (temps for 39 or higher, local infection signs)
- Outpatient
 - Daily washing with mild soap and warm water
 - Application of cream and gauze or Xeroform; net to hold in place
- Graft and Donor Care
 - Grafts secure and well-padded (big bulky dressing placed in OR...drains placed so you can irrigate)
 - Soak grafts as directed
 - Visualized by day 5, often before (after day 5 most grafts are open)
 - Donor sites cared for per institution
 - Goal is for grafts to take (stick), donors to heal and be re-harvested in big burns (about 2 weeks for reharvest)
 - Note that most patients complain about pain at donor site more than the graft site

Special Considerations

- Preheat the room; keep it warm (want it around 38-degrees)
- Perfusion and peripheral pulses below the burn. A circumferential burn can cut off circulation.
- Infection: expectations & prevention (will likely infect with resident bacteria)
- Anxiety; family will often ask ridiculous questions d/t anxiety, pt will have anxiety also. Rule is 1-day for percentage of burned area...so let family know what to expect.
- Body image changes (pt will probably have scars)

- The nurse as coach (be enthusiastic, this helps pt b/c they are exhausted)
- Morphine gold standard - meperidine/demerol contraindicated b/c the meperidien builds up, also see a lot of fentanyl, methadone, dilaudid
- Corneal examinations, check for this!
- Blanket consents for surgery if pt can't sign for each little thing
- Visitors, peer counselors (be careful for over-visiting...if visitor is quiet and lets patient sleep this is fine...but if visitor causes pt to not rest, this is not good)
- Sleep (sleep is golden...you have to sleep to heal)

When to do an Escharotomy?

- Pulse not present distal to a burn
- Waning pulse in first 8 to 12 hours distal to a burn
- Prevention = elevation!

Presentation to ICU

- (no airway involvement)
 - Thirsty
 - Edematous
 - Cold (probably over-iced)
 - Dependent extremities (!)
 - Distraught, tired, denying family
 - "Can't I just go home?"
- Admission Priorities
 - Airway management
 - Ventilation
 - Perfusion
 - Accurate TBSA assessment
 - Concomitant injuries
 - Family (give them info)
 - Burn care is last....it is functionally sterile in the beginning. Get the ABCs done first)
- Graft Priorities
 - Survival (save the life)
 - Function (preserve the function via contracture release)
 - Cosmesis
- Special Problems
 - Dysfunctional families (give consistent info and support)
 - Intentional burning (see more in children, unfortunately)

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