NUTRITIONAL MANAGEMENT OF BURN PATIENTS

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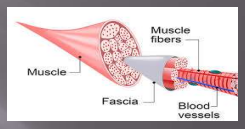
Conditions Treated in Burn Units

- Burns
- Inhalation injury
- Necrotizing soft tissue infections/Necrotizing fasciitis
- Bullous Phemphigoid
- Stevens-Johnson Syndrome (SJS)
- Toxic Epidermal Necrolysis Syndrome (TENS)
- Frost Bite Injury
- Antiphospholipid Syndrome



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Burns


Flash


Flame


Scald


Chemical


Electrical


Contact

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Smoke Inhalation Injury

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Necrotizing Soft Tissue Infections/Necrotizing Fasciitis


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Bullous Pemphigoid

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Stevens- Johnson Syndrome/Toxic Epidermal Necrolysis

<15% TBSA is SJS

>30% is TEN

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Frostbite

Same patient. Required multiple amputations on both hands.

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Vasculitis & Antiphospholipid Syndrome

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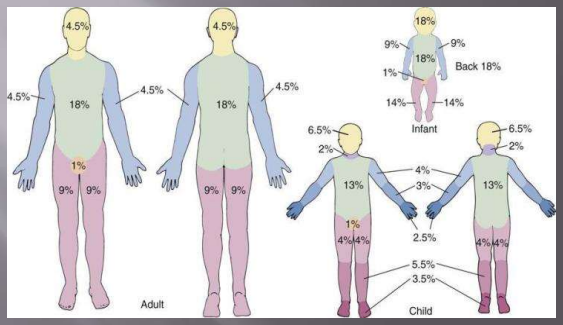
Rule of Nines



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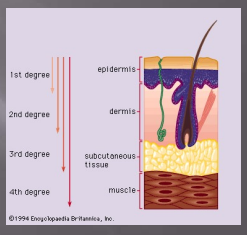
Pathophysiology of Burns

Severity of Injury:
-% Total Body Surface Area (TBSA)
-Depth of Injury

- Superficial (1st degree)
- Partial thickness (2nd degree)
- Full-thickness (3rd/4th degree) – including muscle
- ≥3rd degree requires grafting
  - Depending on severity, may require escharotomy or fasciotomy



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Wounds Associated with Full Thickness Burns

Escharotomies & Fasciotomies

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Wounds Associated with Full Thickness Burns

Donor Sites

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Metabolic Response

- **Ebb Phase-the first 72 hours**
  - Hypovolemia
  - Shock
  - Tissue hypoxia
  - Decreased cardiac output
  - Decreased oxygen use
  - Reduction in body temperature
  - Decreased insulin levels
- **Flow Phase-3 to 5 days post injury**
  - *Acute response*: Increase in: acute-phase proteins, catecholamines, cortisol, glucagon, cytokines, O2 consumption, REE, temperature, tissue perfusion.
  - *Adaptive response*: Decrease in hypermetabolic rate, potential for restoration of body protein/LBM – can last for 9-12 months post-burn.
- Metabolic rate peaks around 7-10 days post-burn.

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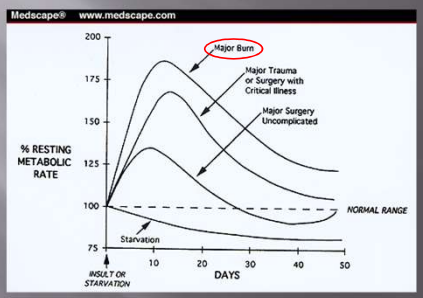
Changes in Metabolic State



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Substrate Utilization

- Carbohydrates
  - Preferred energy source for burn patients
  - High CHO intake promotes wound healing as imparts a protein-sparring effect & shown to have significantly less muscle protein degradation
  - Maximum rate that can be oxidized is 7g/kg/day
    - Pt may need more but may not be able to utilize more
    - If overfeed glucose, may lead to:
      - Respiratory issues
      - Hyperglycemia
      - Glucosuria
      - Shock liver

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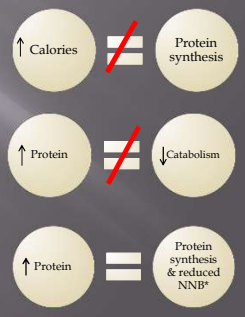
Substrate Utilization

- Protein
  - Increased proteolysis
  - Increased muscle atrophy
  - Regardless of protein intake, will still experience loss of LBM due to *hormonal and inflammatory responses*



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Substrate Utilization

- Fat
  - Lipolysis is suppressed and utilization of lipids for energy is reduced
  - Increased beta-oxidation of fat provides fuel during hypermetabolic state
    - BUT, only 30% of free fatty acids are degraded, the remaining accumulate in liver
      - Higher amounts adversely affects immune system
  - Negative impact on hospital LOS and infectious risk reported with lipid intake >35% of total energy requirements (compared to 15%)

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Importance of Nutrition in Burn Unit Patients

Protein-Calorie Malnutrition occurs rapidly in Burn Unit patients and causes:

- Impaired wound healing
- Muscle wasting
- Immuno-compromise for months after injury
- Growth retardation in children

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Factors in Nutrition Assessment

Age
Gender
Anthropometrics
%TBSA and thickness
Ventilatory status
Associated injuries
Medications/drips
PMHx
Pre-burn nutritional status
Nutrition focused physical exam

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Determining Calories

- Estimating Needs:
  - Toronto Equation – age/sex/%TBSA/Ht/Wt/24 hr calorie intake/Avg 24 hr temp/propofol
  - Harris Benedict
  - Kcal/kg
  - Activity factor
- Indirect Calorimetry with Respiratory Quotient
  - Add 1.1-1.3 factor for consideration of OR frequency, PT and temperature variations
- Comparison of IC to equations

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Nutrition Assessment: Protein

- Goals:
  - Healing
  - Closure
  - LBM preservation
- Do NOT reduce protein to preserve renal function!
- Significant protein loss via wound exudate despite nutrition support (~110 g/day first 10 days)

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Protein Requirements for Adults

- **Protein Requirements in Adults (use IBW):**
- · <20% burn 1.5-2 g/kg
- · >20% burn 2-2.5 g/kg; may go up to 3 g/kg or more for severe burns/wounds

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Fluid Resuscitation

- **Goal:** maintain the tissue perfusion in the early phase of burn shock, in which hypovolemia finally occurs due to steady fluid extravasation from the intravascular compartment.
- **Fluid resuscitation:** LR (per Parkland formula: 4ml/kg/%TBSA over first 24h).
  - Half of the volume is given in the first 8 hours – can gain 5-13L of fluid[2]
  - The other half over next 16 hours and does not include maintenance fluids
- Goal urine output 0.5-1 ml/kg/hr

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Feeding Route

- Burns <20% TBSA may get by with PO intake alone or may require enteral support depending on depth and/or location of burn
- If ≥20% TBSA or <90% IBW, enteral nutrition is indicated. Goal to start within 24 hours of admission.
- TPN only indicated when enteral support has failed or is contraindicated.

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Oral Route

- Automatic high calorie, high protein diet
- Concentrated oral supplements
- Protein modulators
  - Glutamine, Juven, Prostat, Promod, Beneprotein, etc
- Calorie counts
  - Despite inaccuracies, should be used to determine next nutrition intervention
    - Low threshold for enteral tube placement for supplemental feeds if needed

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Enteral Support

- DHT placed within 4 hours of admission
  - Gastric vs post- pyloric vs jejunal
  - OK to feed with mean arterial pressure (MAP) >50 mmHg
- Formulas as clinically indicated pending medical status:
  - Standard 1.0/1.5
  - High protein 1.0 kcal/mL
  - Concentrated immune modulators
  - Disease specific
- Pediatric patients >8 years (down to 1 yr) may receive adult TF formula due to high electrolyte losses and increased protein needs

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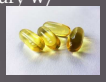
Immuno-Nutrition Agents

- Glutamine
  - Conditionally essential AA which becomes essential following a burn/trauma
  - Primary fuel for enterocytes
  - 1 packet=15 g glutamine; 0.5g/kg/day
  - If given via tube, needs to be mixed w/ 200 ml water
  - Avoid in kidney failure(non-dialysis), liver injury w/ worsening ammonia
    - Highly indicated with renal patients on dialysis



- Arginine
  - Needed for collagen synthesis
  - Avoid in sepsis → forms nitric oxide

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Functions of Additional Vitamin/Mineral Supplements

- MVI with minerals
  - Vitamin A- doses vary pending brand
  - Vitamin C-Only a small amount
  - Vitamin D-usually 400 IU
  - Thiamin
    - Normalizes lactate and pyruvate metabolism
  - Riboflavin
  - Niacin
  - Copper and Selenium needed for wound healing
- Ascorbic Acid 500 mg BID
  - Collagen formation
  - Antioxidant
  - Enhances neutrophil function

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Vitamin/Minerals Cont.

- Zinc 50 mg elemental
  - Cofactor in many intracellular enzymatic reactions related to wound healing
  - Antioxidant
  - Antibacterial properties
  - May only improve healing if serum levels are low
  - Topical zinc appears more beneficial for wound healing
- Vitamin A 10,000 IU/Day
  - Increased immune system response at wound site
  - Aids in collagen synthesis and wound healing
- Vitamin D minimal 1000-2000 IU/day
  - Antibacterial
  - Improved wound healing through indirect means

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Vitamin/Minerals Cont.

- Vitamin E
  - Reduces oxidative stress
  - Can spare selenium
- Folic Acid
  - Need in malnourished, alcoholism
  - Need in larger burns
- Iron
  - Co-factor in collagen synthesis
  - Only supplemented in deficiency

**Monitor duration of supplementation as minerals may interact with each other and inhibit absorption of other wound-healing nutrients

- "Vitamin Holiday" of minimum 2 weeks

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Evaluation and Monitoring

- Labs
  - Twice weekly C-Reactive Protein & prealbumin to monitor trends

Pre-Albumin		11	13	13	14	19
CRP		154	104	68	150	139

  - Monthly Zinc, 25 hydroxy vitamin D, free retinol vitamin A, Vitamin E. **ALL should be checked with a CRP to better interpret results.**
    - CRP > 20 will falsely lower vitamin levels (except for Vitamin E and copper)
- Healing status

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Evaluation and Monitoring

- Tolerance
  - Gastric residuals are checked in large burns, intubated
  - Otherwise, not recommended to check GRV unless accompanied by intolerance symptom
- Transition of EN to PO
  - Calorie counts
  - Supplements
  - Cycled nocturnal TF
- Transition to LTC – educate on continued nutrient dense foods
  - Metabolic demands may remain elevated for 1-2 yrs post burn

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