Metabolic Stress

Chapter 25

Response to Stress - Nutrition Therapy

- Balance between prevention of PEM and complications of nutrition support
- Consider status prior to illness, level of injury, current metabolic changes

Response to Stress - Nutrition Therapy

- Assessment
  - Many standard measures not valid or reliable
  - Family members important source of information
  - Measured weight and visceral protein status may be affected by fluid balance
  - Indirect calorimetry most accurate for estimating energy requirements

Response to Stress - Nutrition Therapy

- Assessment
  - Energy estimates – equations
    - Mifflin-St. Jeor or Harris-Benedict
    - Use stress and injury factors
    - Initial caloric goals: 25-35 kcal/kg
  - Protein
    - 1.2-1.5 g protein/kg
  - “Permissive underfeeding”
    - 14 kcal/kg, 1.2 g protein/kg

TABLE 25.4

Calculation of Energy and Protein Requirements: Activity and Stress Factors for Hypermetabolic Conditions

To calculate total energy requirements for the hospitalized patient:

REE (Resting Energy Expenditure) × Activity Factor × Injury Factor

Harris Benedict Equation

REE for females = 655.1 + 9.6 W + 1.9 H − 4.7 A

REE for males = 66.5 + 13.8 W + 5.0 H − 6.8 A

[W = weight in kg; H = height in cm; A = age in years]

Mifflin-St. Jeor Equation

Females: 10 W + 6.25 Ht − 5 Age − 161

Males: 10 W + 6.25 Ht − 5 Age + 5

[W = weight in Kg; Ht = height in cm; and Age = age in years]

Activity Factors	*Average Injury Factors*
Out of bed 1.2	Surgery 1.0—1.3
Confined to bed 1.1	Infection 1.0–1.4
	Skeletal trauma 1.2–1.4
	Head Injury 1.5

Protein Requirements

RDA 0.8 g protein/kg

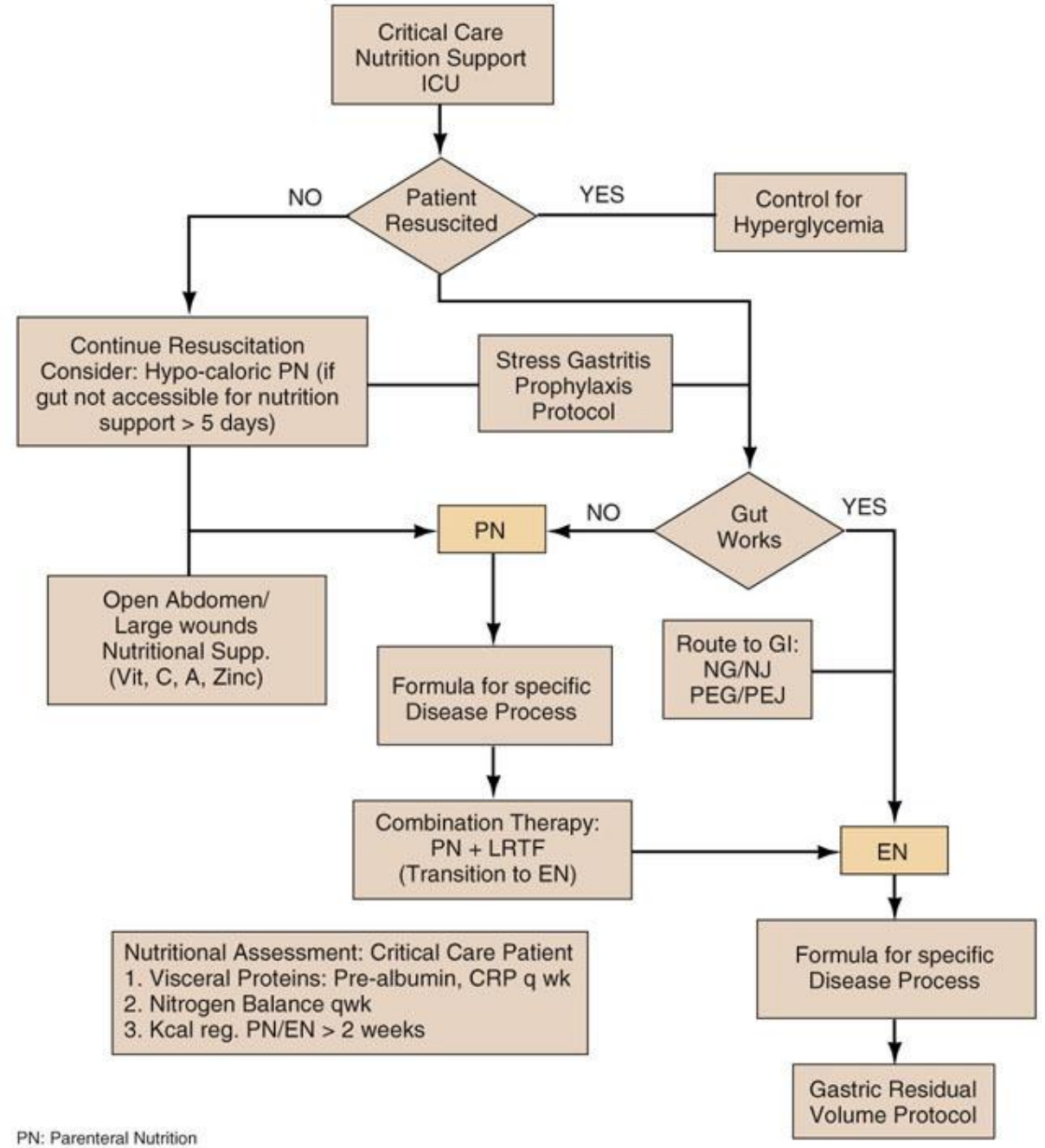
Minor surgery 1–1.1 g protein/kg

Major surgery 1.2–1.5 g protein/kg

Burn 1.5–2.0 g protein/kg

Response to Stress - Nutrition Therapy

- Interventions
  - Oral preferred route
  - Early initiation of nutrition support with specific dg
  - First consider enteral
  - Specialty formulas available



PN: Parenteral Nutrition
EN: Enteral Nutrition
NG/NJ: Nasogastric/Nasojejunal
PEG/PEJ: Percutaneous Endoscopic Gastrostomy/ Percutaneous Endoscopic Jejunostomy

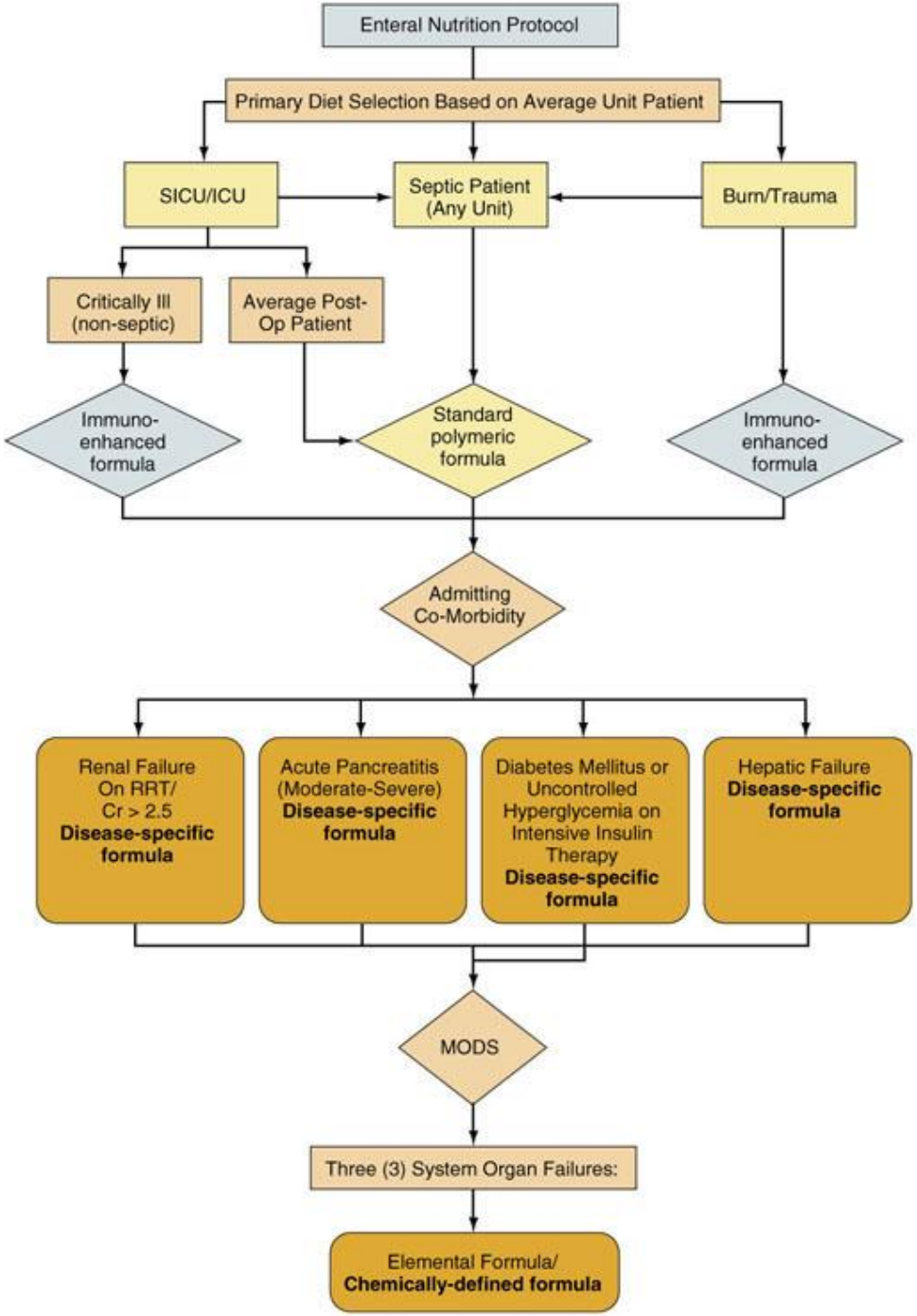


TABLE 25.5

Enteral Formulas in Metabolic Stress

Formula/Manufacturer/ Basic Nutrition Information	Carbohydrate Source	Protein Source	Lipid Source	Rationale for Metabolic Stress
Pivot© (Ross) **Caloric Density:** 1.5 kcal/mL **Osmolality:** 595 mOsm/kg water	46% (corn syrup solids)	25% partially hydrolyzed sodium caseinate, whey protein hydrolysate	Structured lipid (interesterified sardine oil and medium chain triglycerides), soy oil, canola oil	Arginine—13 g/L; glutamine (inherent): 6.5 g/L; omega-3 fatty acids (EPA, 2.6 g/L; DHA: 1.3 g/L); fructooligosaccharides (FOS) and increased antioxidants
Crucial© (Nestle) **Caloric Density:** 1.5 kcal/mL **Osmolality:** 375 mOsm/kg water	36% (maltodextrin)	25% (hydrolyzed casein with added amino acid fortification)	Marine oil, MCT, and soybean oil	n6:n3 ratio of 1.5:1; fortified with arginine, vitamin C, A, zinc and beta-carotene
Impact© (Novartis) **Caloric Density:** 1.0 kcal/mL **Osmolality:** 375 mOsm/kg water	53% (hydrolyzed cornstarch)	22% (sodium and calcium caseinates, L-arginine 12.5 g/L)	25% (palm kernel oil, sunflower oil, menhaden oil)	EPA/DHA: 1.7 g/L; n-6 : n-3 ratio: 1.4:1.0; fortified with arginine—also available with added fiber
Impact Glutamine© (Novartis) **Caloric Density:** 1.3 kcal/mL **Osmolality:** 630 mOsm/kg water	46% (maltodextrin)	24% (wheat protein hydrolysate, free amino acids, sodium caseinate)	30% (palm kernel oil, menhaden oil, sunflower oil)	Glutamine: 15 g/L; L-arginine: 16.3 g/L; dietary nucleotides: 1.6 g/L; n-6: n-3 ratio: 1.4:1.0; added probiotic with soy and hydrolyzed guar gum
Periative© (Ross) **Caloric Density:** 1.3 kcal/mL **Osmolality:** 460 mOsm/kg water	55% (corn maltodextrin)	20.5% (partially hydrolyzed sodium caseinate, hydrolyzed lactalbumin)	Canola oil, MCT	.6 g of FOS/8 fl oz (6.5 g/L and 9.8 g/ 1,500 mL); fortification with arginine

Response to Stress - Nutrition Therapy

- Interventions
  - Supplemental nutrients to consider:
    - Arginine, glutamine
    - Branched-chain amino acids: isoleucine, leucine, valine
    - Omega-3 fatty acids
    - Modify type of lipid; menhaden oil, marine oil, structured lipids
    - Sources of fiber
    - Probiotics, prebiotics, synbiotics

Response to Stress - Nutrition Therapy

- Interventions
  - Complications of enteral include
    - Hyperglycemia
    - Electrolyte imbalances
    - Aspiration
    - Mechanical complications

Response to Stress - Nutrition Therapy

- Interventions
  - Total parenteral nutrition (TPN)
    - Reserved for NPO status, if enteral access not viable or unable to meet needs (volume)
    - Hyperglycemia most critical concern
    - Other concerns: catheter occlusion, infection, hyprtriglyceridemia, intestinal atrophy, electrolyte disturbances, refeeding syndrome

Burns

- Tissue injury caused by exposure to heat, chemicals, radiation, or electricity
- Depth of wound and body surface are used to classify
  - Superficial
  - Superficial partial thickness
  - Deep partial thickness
  - Full thickness
  - See Table 25.6

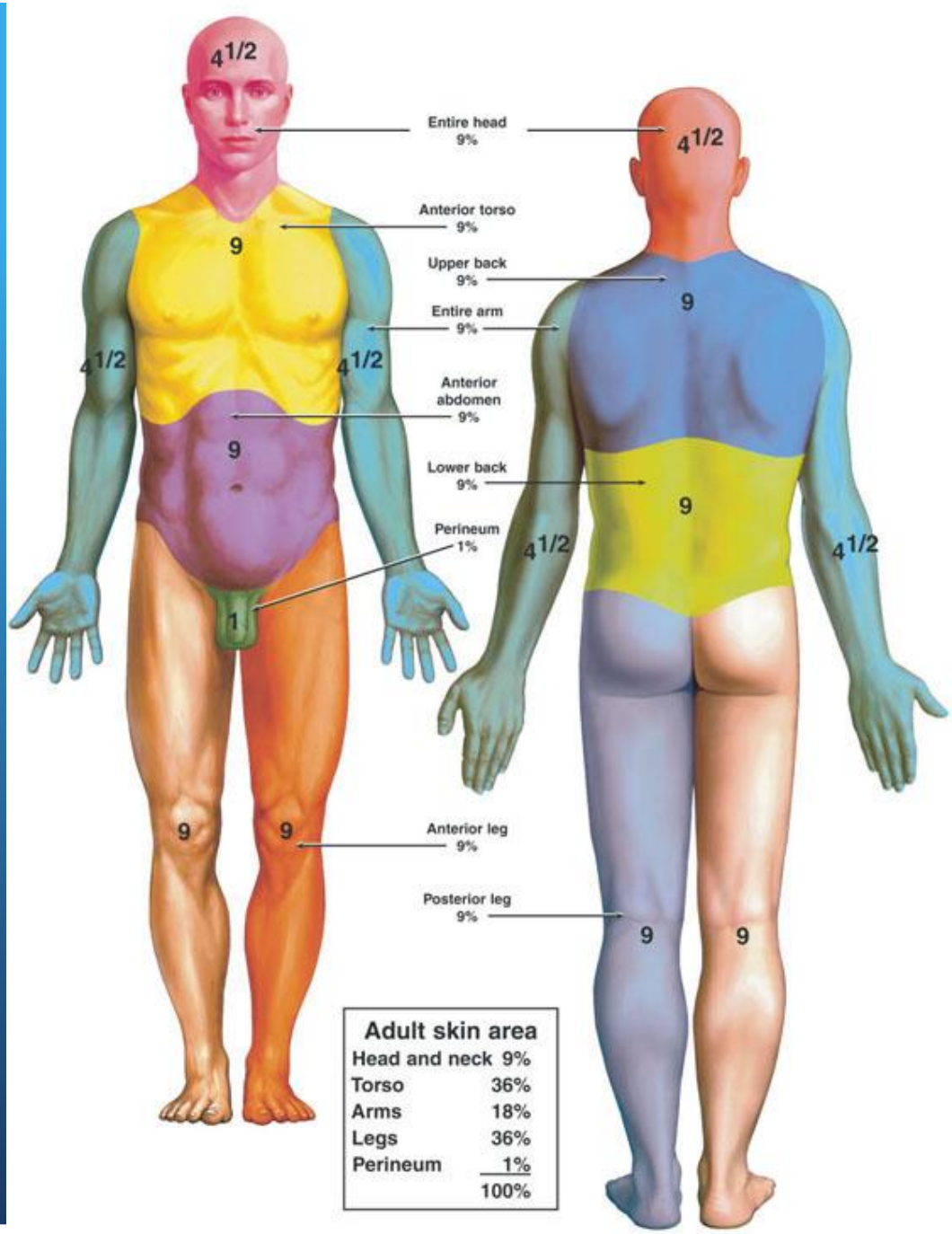
TABLE 25.6

Characteristics of Burns Based on Depth

Classification	Cause	Characteristics			
		Appearance	Sensation	Healing Time	Scarring
Superficial	Ultraviolet light, very short flash (flame exposure)	Dry and red; blanches with pressure	Painful	3 to 6 days	None
Superficial partial-thickness	Scald (spill or splash), short flash	Blisters; moist, red and weeping; blanches with pressure	Painful to air and temperature	7 to 20 days	Unusual; potential pigmentary changes
Deep partial-thickness	Scald (spill), flame, oil, grease	Blisters (easily unroofed); wet or waxy dry; variable color (patchy to cheesy white to red); does not blanch with pressure	Perceptive of pressure only	More than 21 days	Severe (hypertrophic) risk of contracture
Full-thickness burn	Scald (immersion), flame, steam, oil, grease, chemical, high-voltage electricity	Waxy white to leathery gray to charred and black; dry and inelastic; does not blanch with pressure	Deep pressure only	Never (if the burn affects more than 2% of the total surface area of the body)	Very severe risk of contracture

Burns

- Rule of “Nines” used to estimate BSA
  - Used in assessment of extent of injury, basis for fluid and medication recommendations



Burns

- Pathophysiology
  - Excessive inflammatory process
  - Rapid fluid shifts and accumulation
  - Fluid loss from wound
  - Metabolic stress; hypermetabolism, catabolism, immune, hormonal response
  - Respiratory complications

Burns

- Treatment
  - Topical agents
  - Clean, debride, dress wounds
  - Skin grafting

Burns

- Nutrition Therapy/ Implications
  - 20% body protein can be lost
  - Fluid imbalance, pain, immobility
  - Wound healing requires optimum nutrition
  - Weight fluctuations (d/t fluid shifts and resuscitation)

Burns

- Nutrition Therapy/ Assessment
  - Estimate energy using indirect calorimetry
  - Curreri equation can be used at peak of burn injury
    - Needs do not increase beyond 50-60% total body surface area burn
  - Mifflin-St. Jeor equation with injury factor 1.3-1.5
  - Energy needs increase with fever, infection, sepsis

Burns

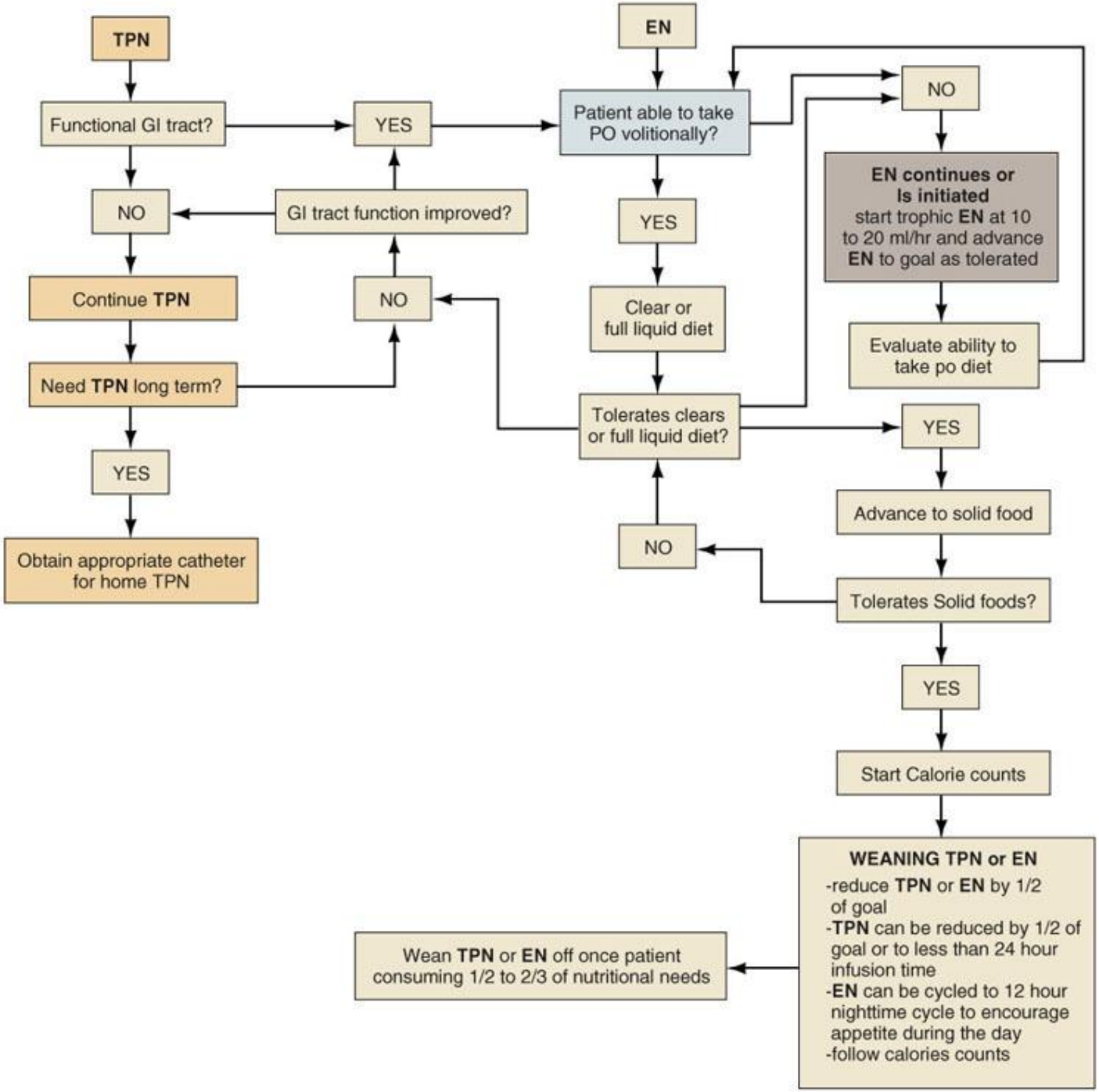
- Nutrition Therapy/ Assessment
  - Protein 1.5-2 g protein/kg
  - Negative nitrogen balance may not be totally prevented
  - Set goal to minimize losses and promote wound healing

Burns

- Nutrition Therapy/ Interventions
  - Nutrition support - enteral
    - Early feeding associated with prevention of infections and Curling's ulcer, and reduction in protein catabolism
    - Focus on higher protein (20-25% of kcal)
    - Supplemental arginine, glutamine, omega-3 fatty acids
  - PN if enteral cannot meet needs

Burns

- Nutrition Therapy/ Interventions
  - Nutrition support - PN
    - Avoid overfeeding, control hyperglycemia
  - Oxandrolone (anabolic steroid)
    - Used to promote protein synthesis
  - Additional vitamins, minerals, trace elements
    - Vitamins C, A, E, zinc routinely used
  - Wean from nutrition support when pt. can meet at least 60% of needs orally



Surgery

- Nutritional implications if…
  - Patient enters surgery malnourished or overnourished
  - Surgery will interrupt normal nutrition processes
  - Preoperative changes in weight, albumin, CRP

Surgery

- Clinical manifestations… depend on type of procedure
  - 12 hours pre-op NPO
  - May have nasogastric tube
  - Anesthesia may result in postop. ileus (lack of motility), general paralysis of GI tract
  - PO resumed with bowel sounds and gas production

Surgery

- Nutrition Implications/ Interventions
  - Post-operative metabolic stress
  - Progression for postoperative feeding individualized
    - NPO to solid foods as quickly as possible
  - Individualize energy and protein using REE and activity and injury factors
  - Nutrition support if NPO prolonged