THE ALLIANCE ADVANCEMENT LEARNING SERIES

TRANSPLANT FOCUS | THE ALLIANCE ADVANCEMENT LEARNING SERIES

Identifying Nutrition Risks and Applying Them to Transplant Care

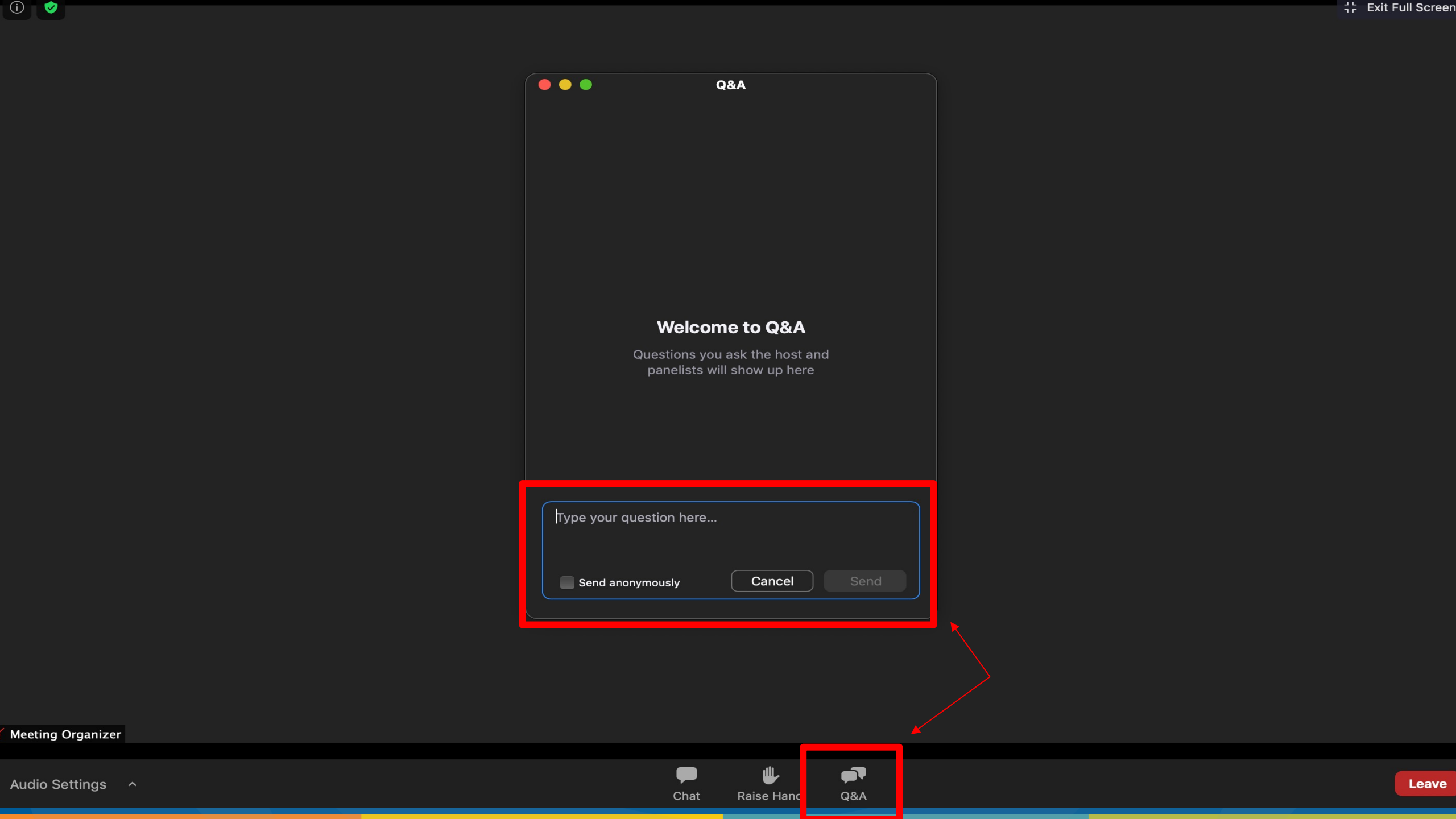
Speakers:

Charles Mueller, PhD, RDN, CDN, CNSC | Courtney Dunn

March 25, 2021

THE Alliance

Advancing Organ Donation & Tranplantation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INNOVATION FOCUS

THE ALLIANCE ADVANCEMENT LEARNING SERIES

Implementing a Successful Workforce Model in a Virtual Environment

Tuesday, March 30, 2021
2:00pm – 3:00pm ET
11:00am – 12:00pm PT

Available Continuing Education Credits:
1 CEPTC Credit, 1 Nursing Contact Hour

SPEAKERS:

Paul Myoung
Senior Administrative Director
Massachusetts General Hospital

Kristine Browning, RN
Senior Director of Quality & Regulatory Compliance
LifeGift

Michelle Gilbert
Director of Communications Center for Donation
LifeGift

Rebecca McKay
Director of Human Resources
LifeGift

DONATION FOCUS

THE ALLIANCE ADVANCEMENT LEARNING SERIES

Donor Management Snags: Overcoming Unique Challenges in the Donation Process

Tuesday, April 6, 2021
2:00pm – 3:00pm ET
11:00am – 12:00pm PT

Available Continuing Education Credits:
1 CEPTC Credit, 1 Nursing Contact Hour

SPEAKERS:

Liz Peatee, MSBS, CPTC
Donation Coordinator
Gift of Life Michigan

Rachael Wulf, MSBS-HDS, CPTC
Manager of Organ Services
Nevada Donor Network

THE ALLIANCE ADVANCEMENT LEARNING SERIES

Continuing Education Information

Nursing

The Organ Donation and Transplantation Alliance is offering **1.0 hours of continuing education credit** for this offering, approved by The California Board of Registered Nursing, Provider Number CEP17117. No partial credits will be awarded. CE credit will be issued upon request within 30 days post-webinar.

CEPTC

The Organ Donation and Transplantation Alliance will be offering **1.0 Category I CEPTC credits** from the American Board for Transplant Certification. Certified clinical transplant and procurement coordinators and certified clinical transplant nurses seeking CEPTC credit must complete the evaluation form within 30 days of the event.

Dietitian CPEU

The Organ Donation and Transplantation Alliance will be offering **1.0 Registered Dietitian CPEU** from the Commission on Dietetic Registration. Certified clinical dietitians seeking Dietitian CPEU credit must complete the evaluation form within 30 days of the event.

Certificate of Attendance

Participants desiring CE's that are not being offered, should complete a certificate of attendance.

- Certificates should be claimed within 30 days of this webinar.
- We highly encourage you to provide us with your feedback through completion of the online evaluation tool.
- Detailed instructions will be emailed to you within the next 24 hours.
- You will receive a certificate via email upon completion of a certificate request or an evaluation
- Group leaders, please share the follow-up email with all group participants who attended the webinar.

THE Alliance

Advancing Organ Donation & Tranplantation

Meet Our Presenters

Maryanna Tosi
RD, CDN, CNSC, CCTD

MODERATOR

Registered Dietitian

Courtney Dunn
MS, RDN, CNSC

Clinical Dietitian

Charles Mueller
PhD, RDN, CDN, CNSC

Clinical Associate Professor

NYU Langone Health

NEW YORK UNIVERSITY

UC San Diego Health

Nutrition focused physical exam: Bringing it into the transplant process

Charles Mueller, PhD, RDN, CDN, CNSC

Clinical Associate Professor

Department of Nutrition and Food Studies

NYU | STEINHARDT

Objectives

- Define “malnutrition” (etiology-based definitions)
  - History
  - Phenotype
  - Etiology
- Identify clinical manifestations
  - Starvation-related
  - Chronic disease-related (with or without systemic inflammation)
  - Acute disease/trauma= related
- Define and describe ”nutrition focused physical examination”
- Apply to transplant populations
  - Type
  - Pre, immediate post, post

American Society for Parenteral and Enteral Nutrtion (A.S.P.E.N.) Board of Directors and Clinical Practice Committee. Definition of terms, style, and conventions used in A.S.P.E.N. Board of Directors-approved documents. American Society for Parenteral and Enteral Nutrition. http://www.nutritioncare.org/Library.aspx. Published July, 2010. Accessed July 8, 2010.

Malnutrition is defined as "an acute, subacute or chronic state of nutrition, in which varying degrees of overnutrition or undernutrition with or without inflammatory activity have led to change in body composition and diminished function.)

What is malnutrition, historically

- Protein calorie malnutrition
- Marasmus
- Kwashiorkor
- Etiology-based definitions of malnutrition
- GLIM

Protein-calorie malnutrition

Welcome Trust Working Party. Classification of Infantile Malnutrition. *Lancet.* 1970;2:302-3

Weight (% of standard)	Edema	
	Present	Absent
80-60	Undernourished	Kwashiorkor
<60	Marasmus	Marasmic-kwash

Waterlow JC. Classification and definition of protein-calorie malnutrition. *Br Med J.* 1972;3:566-9.

> "…kwashiorkor results from a deficiency of protein with a relatively adequate energy supply, whereas marasmus is caused by an overall deficiency of protein and energy."

Marasmus: clinical characteristics

Balint JP. Physical findings in nutritional deficiencies. *Pediatr Clin North Am.* 1998;45:245

- Emaciated and weak
- Bradycardic, hypotensive, hypothermic
- Thin dry skin, hair easily plucked
- Ravenously hungry and with stimulation mental status is normal

Kwashiorkor

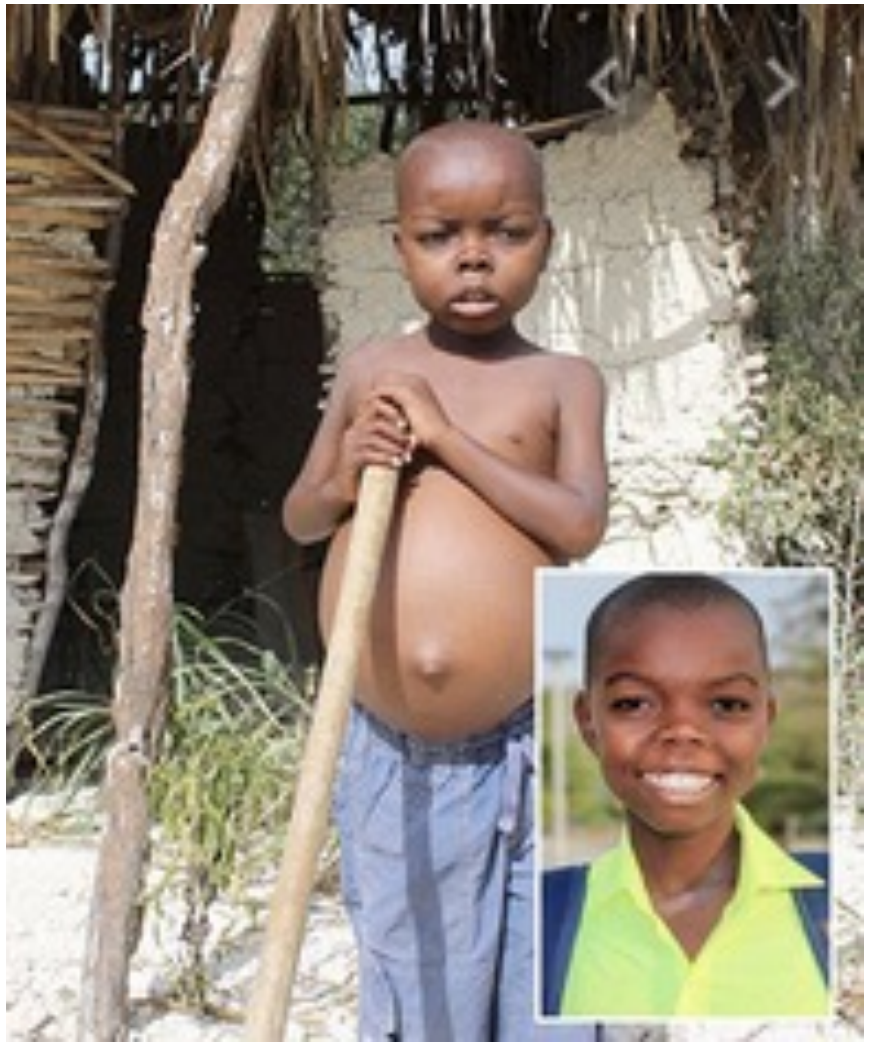
Williams CD. A nutritional disease of children associated with a maize diet. *Arch Dis Chil.* 1933;8:423

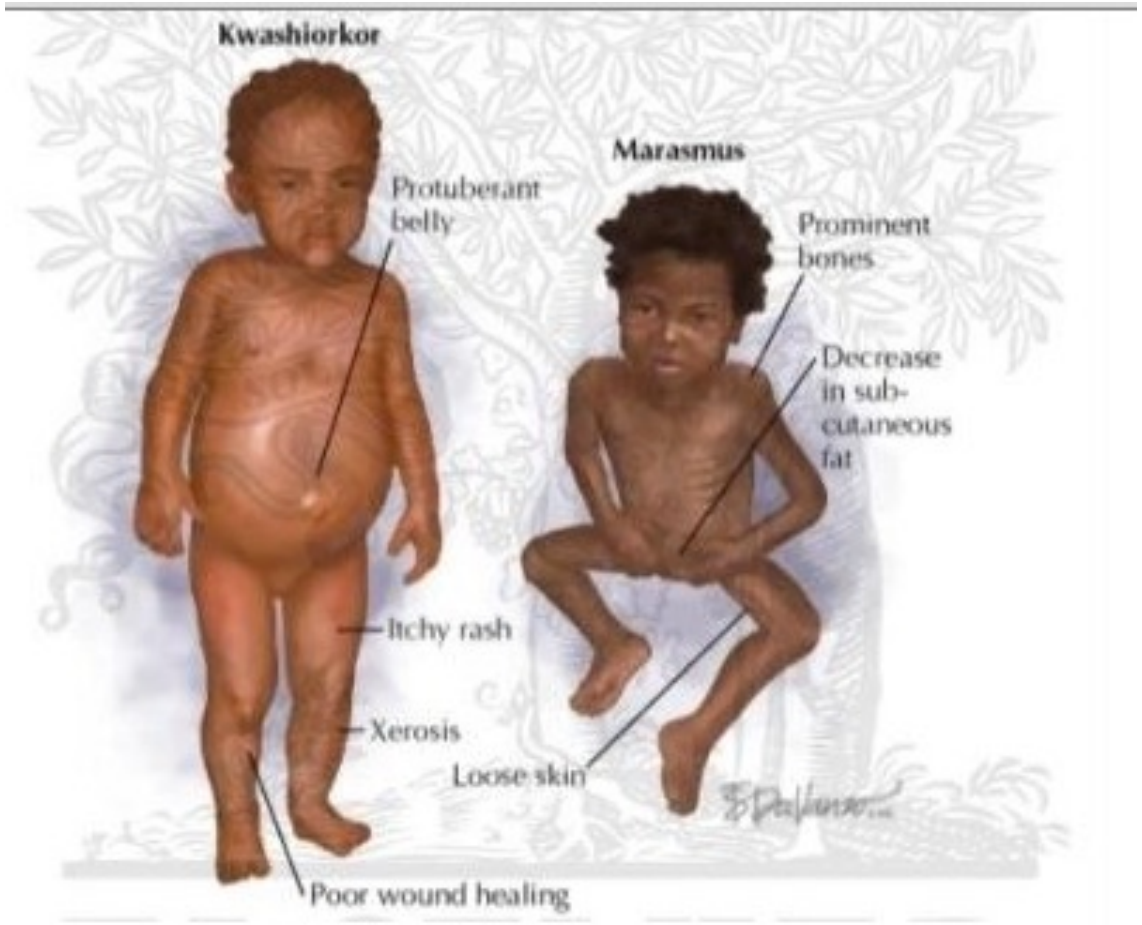
- Derived from the name mother in Ghana used to describe the disease in their children: “the disease of the first son when the second son is born.”
- Reflects the association between of kwash and the weaning process from breast-feeding to a protein deficient, grain based diet.

Kwashiorkor clinical characteristics

Balint JP. Physical findings in nutritional deficiencies. *Pediatr Clin North Am.* 1998;45:245

- Anorexic
- Moon-face, massive peri-orbital and pitting edema of lower extremities and hands
- Protuberant bellies with hepatomegaly (hepatic steatosis), abdominal distention with dilated intestinal loops
- Dermatosis, Dry skin, hair easily plucked
- Irritable
- Susceptible to infection




Kwashiorkor
Protuberant belly
Itchy rash
Xerosis
Poor wound healing
Marasmus
Prominent bones
Decrease in sub-cutaneous fat
Loose skin

Osorio SN. Reconsidering kwashiorkor. *Top Clin Nutr.* 2011;26(1):10-13.

- Kwash has been reported in a breastfed infant
- Study reporting resolution of edema before albumin levels normalized
- Kwash associated with HIV, TB; and frequently follows outbreaks of measles and dysentery.
- Strong likelihood for the role of inflammation in kwash.

Paradigms

- “Visceral protein stores”
- Pre albumin and retinol binding protein are more sensitive indicators of nutritional status than alb because they have shorter half lives.
- Poor nutritional status due to “involuntary weight loss”
- Outcome: preserve lean body mass

Fuhrman MP et al. Hepatic proteins and nutrition assessment. *J Am Diet Assoc.* 2004;104(8):1193-1320.

- Historically, a large literature associated nutritional status (weight loss, poor oral intake) with transport protein levels.
- When serum levels were low, protein/calorie supplementation will "treat".
- But was (is) this cause/effect?

- Do people who lose significant amount of weight on "diets" have low alb?
- Do people with anorexia nervosa have low alb?
- Why does a well nourished person post trauma have a low albumin? Are they malnourished? Do they have "low protein stores?"
- Why does an acutely ill patient who has lost a few pounds in a couple of weeks have an albumin of 2.8 mg/dL?

Serum transport proteins and malnutrition

Fuhrman MP. Charney P, Mueller C. Hepatic proteins and nutrition assessment. *J Am Diet Assoc.* 2004;104:1258-64

12 studies correlate serum protein concentrations with duration of nutrition support, anthros, morbidity and mortality ***and conclude/assume that nutrition is the primary causative variable.***

11 studies correlate serum protein concentrations with morbidity and mortality, some inflammatory markers, anthros, and ***conclude that inflammation (acute and chronic illness) is the primary causative variable.***

Summary
(last slide ASPEN presentation 2005)

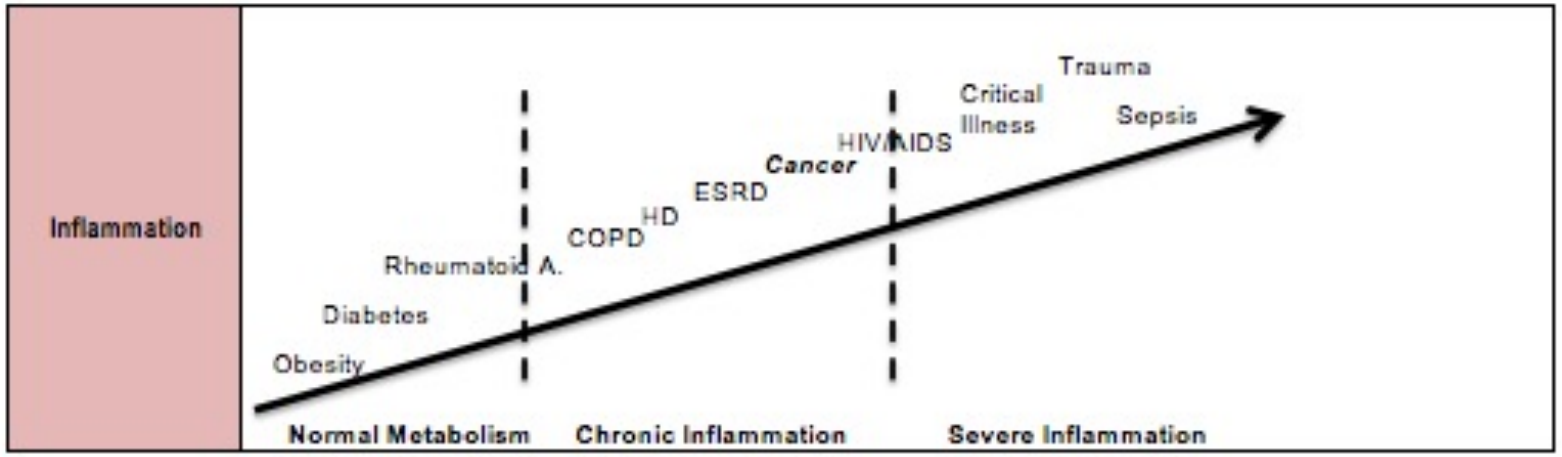
- ~~Protein calorie malnutrition~~
- ~~Marasmus~~
- ~~Kwashiorkor~~

- Uncomplicated malnutrition (starvation metabolism, anabolism possible): replete
- Disease-related malnutrition (altered metabolism): support and do no harm- novel treatments

Jensen GL, Mirtallo J, Compher C, et al. Adult starvation and disease-related malnutrition: A proposal for etiology-based diagnosis in the clinical practice setting from the International Consensus Guideline Committee. *JPEN J Parenter Enteral Nutr.* 2010;34(2):156-159.

Condition	Definition	Examples
Starvation–related malnutrition	Chronic starvation without inflammation.	Anorexia nervosa
Chronic disease–related malnutrition	Chronic diseases or conditions that impose sustained inflammation of a mild to moderate degree.	Organ failure, cancer, rheumatoid arthritis, obesity, metabolic syndrome
Acute disease– or injury–related malnutrition	Acute disease or injury states with marked inflammatory response.	Major infection, burns, trauma, closed head injury

Inflammatory continuum



Mueller C. Inflammation and malnutrition. *Top Clin Nutr.* 2011;26(1):3-9.

Starvation	Cachexia	Acute critical illness or trauma
Deceased BMR	Normal or increased BMR	Increased BMR
Mobilization of fat, sparing of skeletal muscle	Equal mobilization of fat and skeletal muscle	Skeletal muscle breakdown
Decreased protein breakdown	Increased protein breakdown	Marked increase in protein breakdown
Decreased glucose turnover	Normal or increased glucose turnover	Decreased pyruvate dehydrogenase activity, increased gluconeogenesis, insulin resistance, hyperglycemia
Increased fatty acid oxidation/ketosis		Lipolysis, then decreased lipid oxidation, with hepatic lipogenesis and futile lipid cycling, eventual hyperlipidemia
Normal transport protein levels	Decreased transport (negative) acute phase protein levels	Decreased transport (negative) acute phase protein levels
	Increased (positive) acute phase protein levels	Increased (positive) acute phase protein levels

Identification and Diagnosis of Malnutrition

Inflammation	Marked Response		Mild to Moderate		Not Present	
Clinical Characteristics	**Acute Disease/Injury**		**Chronic Disease Related**		**Starvation Related**	
	Non-Severe (Moderate) Malnutrition	Severe Malnutrition	Non-Severe (Moderate) Malnutrition	Severe Malnutrition	Non-Severe (Moderate) Malnutrition	Severe Malnutrition
Energy Intake	<75% for >7 days	<50% for ≥ 5 days	<75% for ≥ 1 month	<75% for ≥ 1 month	<75% for ≥ 3 months	<50% for ≥ 1 month
Weight Loss	1-2% in 1 wk 5% in 1 mo 7.5% in 3 mo	>2% in 1 wk >5% in 1 mo >7.5% in 3 mo	5% in 1 mo 7.5% in 3 mo 10% in 6 mo 20% in 1 yr	>5% in 1 mo >7.5% in 3 mo >10% in 6 mo >20% in 1 yr	5% in 1 mo 7.5% in 3 mo 10% in 6 mo 20% in 1 yr	>5% in 1 mo >7.5% in 3 mo >10% in 6 mo >20% in 1 yr
Body Fat Loss	Mild/Moderate	Mild/Moderate	Mild/Moderate	Severe	Mild	Severe
Muscle Mass Loss	Mild/Moderate	Mild/Moderate	Mild/Moderate	Severe	Mild/Moderate	Severe
Fluid Accumulation	Mild	Moderate to Severe	Mild	Severe	Mild	Severe
Reduced Grip Strength	Not applicable	Measurably Reduced	Not applicable	Measurably Reduced	Not applicable	Measurably Reduced

From White JV et al. JADA. 2012;112(5):730-738.

Jensen GL, et al. GLIM Criteria for the diagnosis of malnutrition: A consensus report from the global clinical nutrition community. *JPEN* 2019;43(1):32-40

- Criteria for the etiology-based malnutrition diagnoses
  - Starvation-related malnutrition
  - Chronic disease with minimal of no perceived inflammation
  - Chronic disease with inflammation
  - Acute disease or injury with severe inflammation
- International consensus

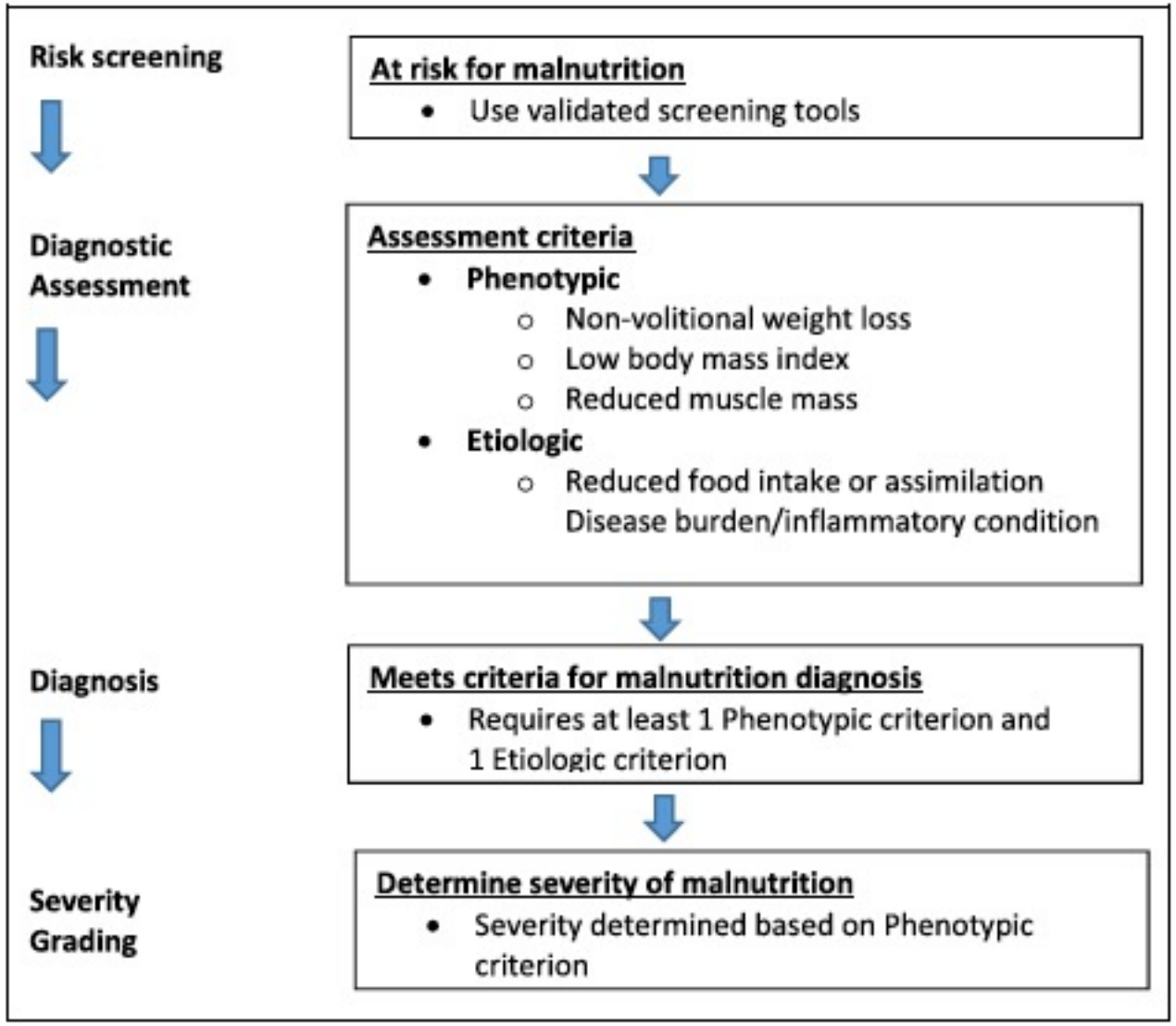


Figure 1. GLIM diagnostic scheme for screening, assessment, diagnosis, and grading of malnutrition.
GLIM, Global Leadership Initiative on Malnutrition.

Screening criteria: distinguishing starvation-related malnutrition from acute and chronic disease-related malnutrition

Anorexia and edema/anasarca/ascites are findings associated with inflammation and therefore acute and chronic disease-related malnutrition

WHO. *Guidelines: Updates on the management of severe acute malnutrition in infants and children.* Geneva:
World Health Organization; 2013.

- Severe acute malnutrition triaged by presence of bilateral edema and presence of appetite in addition to evidence of a disease process.
- Those children who do not have edema and pass an “appetite test” can be treated at home with a *nutritional* supplement
- Those children with edema etc. (“nutritional edema”) must be brought to clinic to be evaluated for a disease process (inflammation).

Inflammation

- Inflammation is integral to normal, injury, and disease related human physiology and metabolism.
- Inflammation is part of immune responses and wound healing processes.
- Its mechanisms function on a cellular level both locally and systemically.
- In addition to immune and healing properties, inflammatory mechanisms affect metabolism both subtly and frankly from short– to long–term duration, even lifelong duration.
- SIRS:

Description: Cellular level

Mueller C. *Top Clin Nutr.* 2011;26(1):3-9

Inflammatory mechanisms are under homeostatic control (pro and anti-inflammatory control) on the cellular level where mRNA expression is modulated which in turn up or down regulates inflammatory proteins (e.g. TNF-alpha, IL-10)

Description: Cellular level

Mueller C. *Top Clin Nutr.* 2011;26(1):3-9

- A defect in translational (mRNA), under genetic influence (?), can lead to autoimmune inflammation (RA).
- Toll-like receptors recognize pathogen-associated molecular patterns of invading microbes and induce signaling cascades that result in pro- and anti-inflammatory cytokines and chemokines.
- Inflammasomes are cellular molecular platforms that also signal cytokine production. Disregulation of inflammasome activity is associate with human heritable and acquired inflammatory diseases, e.g. type 2 diabetes.

Altered metabolism: Why?

- Protein catabolism for glucose production
  - Wound healing, energy
  - Loss from skeletal muscle, connective tissue organs
- Altered protein synthesis
  - Leukocyte proliferation, immunoglobulins
  - Wound healing
  - Acute phase protein synthesis

Carbohydrate metabolism

- Decreased pyruvate dehydrogenase activity (increased alanine, lactate)
- Increased gluconeogenesis
- Insulin resistance
- …hyperglycemia

Lipid metabolism

- Lipolysis increased, then decreased oxidation with advanced SIRS and hepatic lipogenesis
- Futile cycling: lipogenesis and lipolysis without lipid oxidations leading to hyperlipidemia in late SIRS (systemic inflammatory response syndrome)

Protein metabolism

- Proteolysis of skeletal muscle, connective tissue, organs
- …poorly attenuated by exogenous protein and energy
- Peripheral oxidation of leucine, isoleucine and valine
- Alanine, glycine and cysteine transported to liver for gluconeogenesis
- Glutamine release from lean body mass provides NH_3 for metabolic acid excretion and energy substrate for lymphocytes and enterocytes

Negative acute phase proteins

- Decrease synthesis at least 25%: Release of protein ligands (thyroid hormones, retinol, Ca, Fe, etc) increasing tissue uptake
  - Albumin
  - Transferrin
  - Pre albumin
  - Retinol binding protein
  - Fibronectin
  - Insulin-like growth factor

Positive acute-phase proteins

- Increase synthesis at least 25%: Clotting, protease enzyme inhibitors, etc.
  - Fibrinogen
  - Prothrombin
  - Antihemophilic
  - Plasminogen
  - Complement proteins
  - $Alpha_1$ antitrypsin
  - $Alpha_1$ antichymotrypsin
  - Pancreatic secretory trypsin inhibitor
  - Haptoglobin
  - Ceruloplasmin
  - CRP

Mediation: Cytokines

- Cytokines are endogenous proteins or glycoproteins released in small concentrations by cell types:
  - Local: endothelial, mast, tissue fibroblasts, macrophages
  - Systemic: monocytes, neutrophils, basophils, eosinophils, lymphocytes
- Regulate metabolic, hemodynamic, immunologic, and wound healing responses to injury and infection
- Stimulate hypothalmus to produce CRH

TNF

- Stimulates other cytokines
- Stimulated platelet activating factor (PAF)
- Stimulates prostaglandins and leukotrienes
- Activates neutrophils and endothelial cells
- Activate coagulation cascade
- Decreases CO
- Shock
- Stimulates counterregulatory hormones

IL-1

- Induced by TNF
- Works synergystically with TNF in T-lymphocyte proliferation
- Stimulates prostaglandin production by way of the hypothalumus (fever mechanism)
- Increases CO
- Capillary permeability
- Shock

IL-6

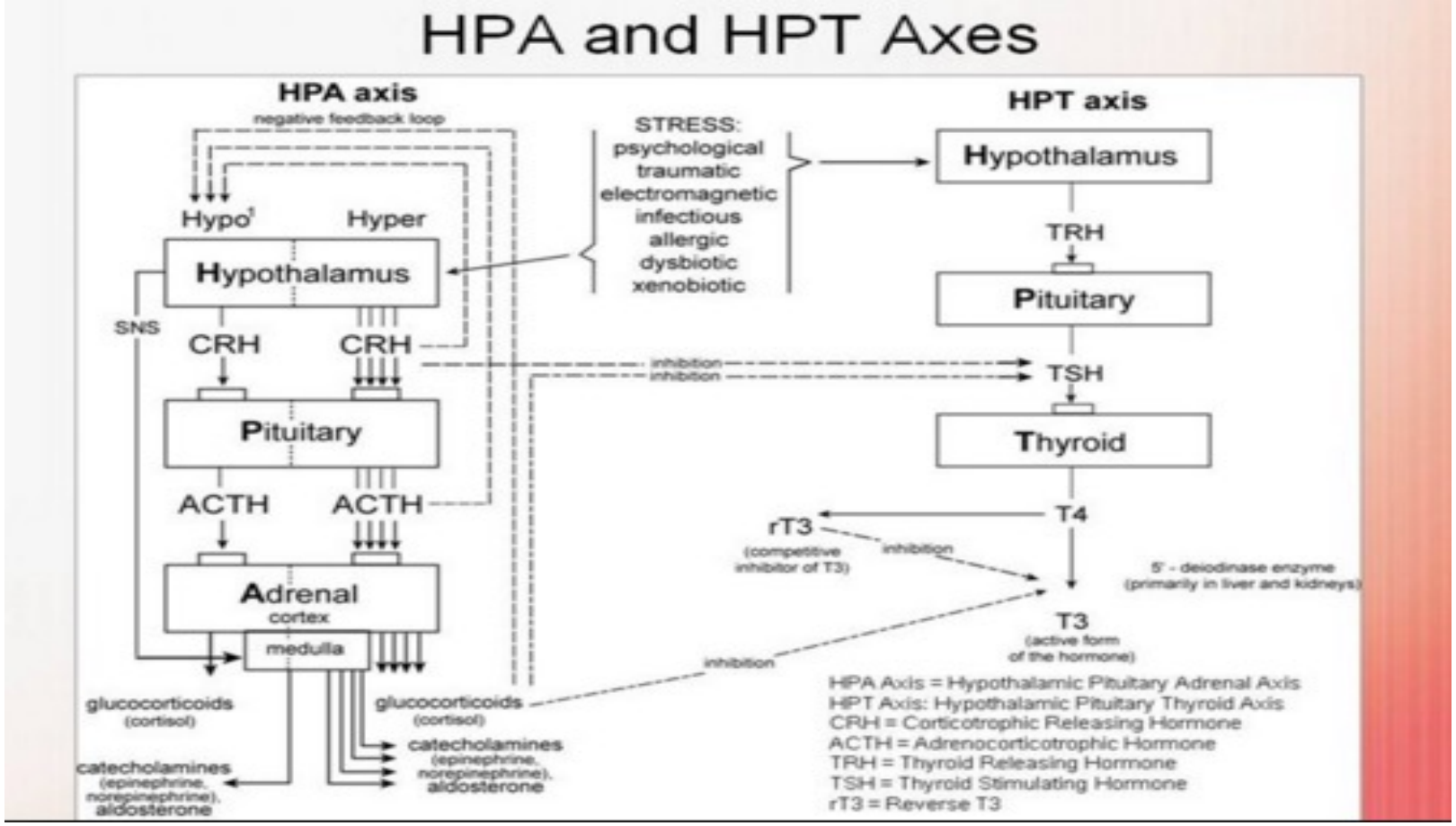
- Activated B and T lymphocytes
- Stimulates hematopoiesis
- Stimulated acute-phase protein production

- Inhibits TNF and IL-1

Mediation: Neuroendocrine

- Cytokines and neurotransmitters stimulate the hypothalmus to produce CRH and arginine vasopressin
- …which stimulates corticotropin (ACTH) in the pituitary which stimulates adrenal cortex to produce cortisol and aldosterone
- CRH stimulates norepinephrine which stimulates CRH...

Hypothalmic Pituitary Adrenal Axis



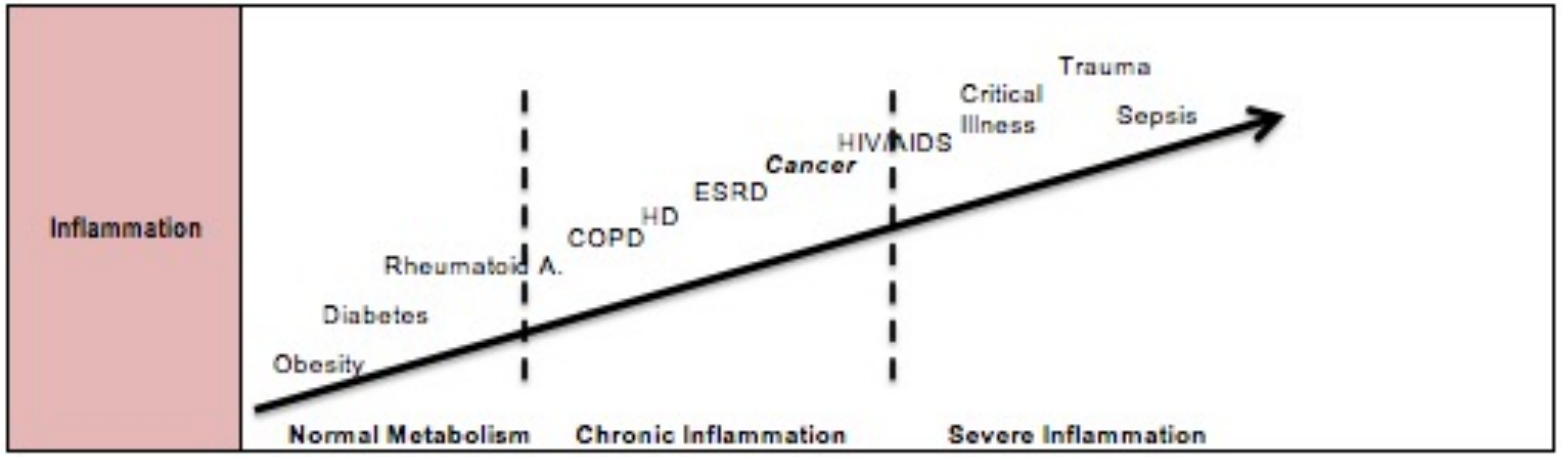
Mediation: others

- PAF: capillary permeability, hypotension, bowel necrosis, TNF production
- Eicosenoids (prostaglandins. Leukotrienes, thromboxanes): vasodilation, vasoconstriction, capillary permeability, platelet aggregation, chemotaxis, leukocyte adhesion
- Complement: stimulates TNF and IL-2 production, ARDS, cardiac dysfunction

Compensatory mediation

- (IL-6)
- Glucocorticoids (inhibit TNF and IL-1)
- IL-4
- IL-10
- IL-11
- IL-13

Inflammatory continuum



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Normal transport protein levels	Decreased transport (negative) acute phase protein levels	Decreased transport (negative) acute phase protein levels
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Critical illness

- ***Systemic inflammatory response syndrome (SIRS)*** refers to the constellation of clinical, hematologic, metabolic, and organ function abnormalities associated with gram-negative and gram-positive sepsis or sepsis of unknown origin. SIRS is not peculiar to sepsis and leads to the same sequelae

  Surgery

  Trauma including burn

  Pancreatitis

  Advanced cancer

  Chronic diseases and conditions

Fajgenbaum DC, June CH. Cytokine storm. *N Eng J Med.* 2020;383(23):2255-73.

- Cytokine storm: COVID 19-related SIRS (in the popular press)
- An immune response: illusive definition distinguishing from systemic inflammation due to various types of pathology and trauma
- Umbrella term
  - Immune dysregulation
  - Systemic inflammation (physiologic and metabolic attributes
  - Organ failure if not successfully treated

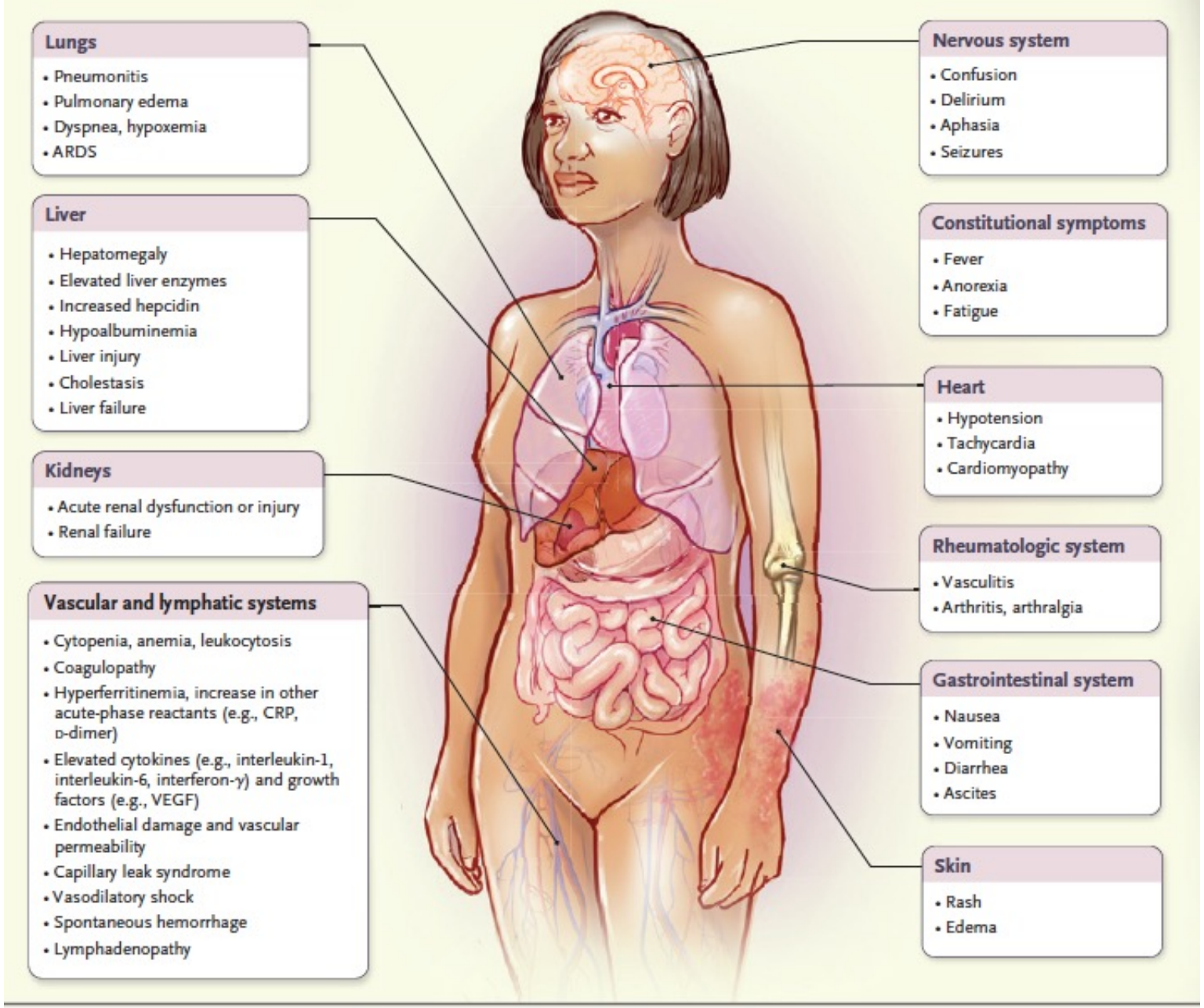


Figure 1. Clinical Presentation of Cytokine Storm.

A wide range of clinical and laboratory abnormalities can be observed in cytokine storm. However, all cases involve elevated circulating cytokine levels, acute systemic inflammatory symptoms, and secondary organ dysfunction (often renal, hepatic, or pulmonary). ARDS denotes acute respiratory distress syndrome, CRP C-reactive protein, and VEGF vascular endothelial growth factor.

Cancer, Anorexia, and Cachexia

Ohnuma T, Adigun R. StatPearls Publishing; Oct 5, 2017

- Cachexia is a syndrome that may accompany a plethora of diseases, including cancer, chronic heart failure, COPD, chronic infection such as AIDS and rheumatoid arthritis. It is associated with central and systemic increases in pro-inflammatory factors, and with decreased quality of life, poor responses to pharmacological treatment and shortened survival. Extensive loss of skeletal muscle mass with or without adipose tissue in cachexia may be contrasted with simple starvation in which fat replaces glucose as the preferred fuel to spare lean body mass. Cancer cachexia results from altered metabolism rather than just an energy deficit and conventional nutrition support cannot reverse it.

Clinical characteristics of cachexia

Argiles JM, et al. The cachexia score (CASCO): a new tool for staging cachectic cancer patients. *J Cachexia Sarcopenia Muscle.* 2011;2:87-93.

- Body weight loss and composition (lean body mass)
- Inflammation/metabolic disturbances
  - CRP, IL6, alb, pre-alb, lactate, trig, anemia, urea, ROS, glu tolerance
- Physical performance
  - Total activity, handgrip strength, stairs climb
- Anorexia (questionnaire)
- Quality of life (questionnaire)

Sarcopenia

- Reduction of muscle mass and function (with age) Adamo & Farrar. *Ageing Res Rev.* 2006;5:310-31
- Reduction of protein synthesis and increase in degredation?
- Myocyte apoptosis?
- Frailty/weakness and functional decline compounded by excessive adiposity

Sarcopenia- causes

- Immobility and lack of exercise
- Increased levels of proinflammatory cytokines (obesity contributes)
- Oxygen free radicals
- Low anabolic hormone production (GH/IGF-1, testosterone)
- Apoptosis (myocyte) Marzetti E, et al. *Exp Gerontol.* 2006:41:1234-8.
- Malnutrition?

Sarcopenia- causes

- Myofiber degeneration → myocyte loss → mitochondrial DNA mutation → myocyte apoptosis Edstrom E, et al. *Physiol Behav.* 2007;10:129-35. Marzetti & Leeuwenburgh. *Exp Gerontol.* 2006;41:1234-38
- Evidence of both dysregulation and adaption of skeletal muscle during healthy aging. Brzeszcznska J, et al. *J Cachexia Sarcopenia Muscle.* 2018;9(1):93-105

Cachexia versus sarcopenia

Roland Y, et al. *Curr Opin Clin Nutr Metab Care.* 2011;14(1):15-21

- Cachexia defined as a metabolic syndrome in which inflammation is a key feature
- Sarcopenia is recognized as a mulitfactorial geriatric syndrome (that is to say, age-related). Definitions focus on muscle mass and function (as measured by strength or gait speed)

- *Treatment approach underlines the differences*

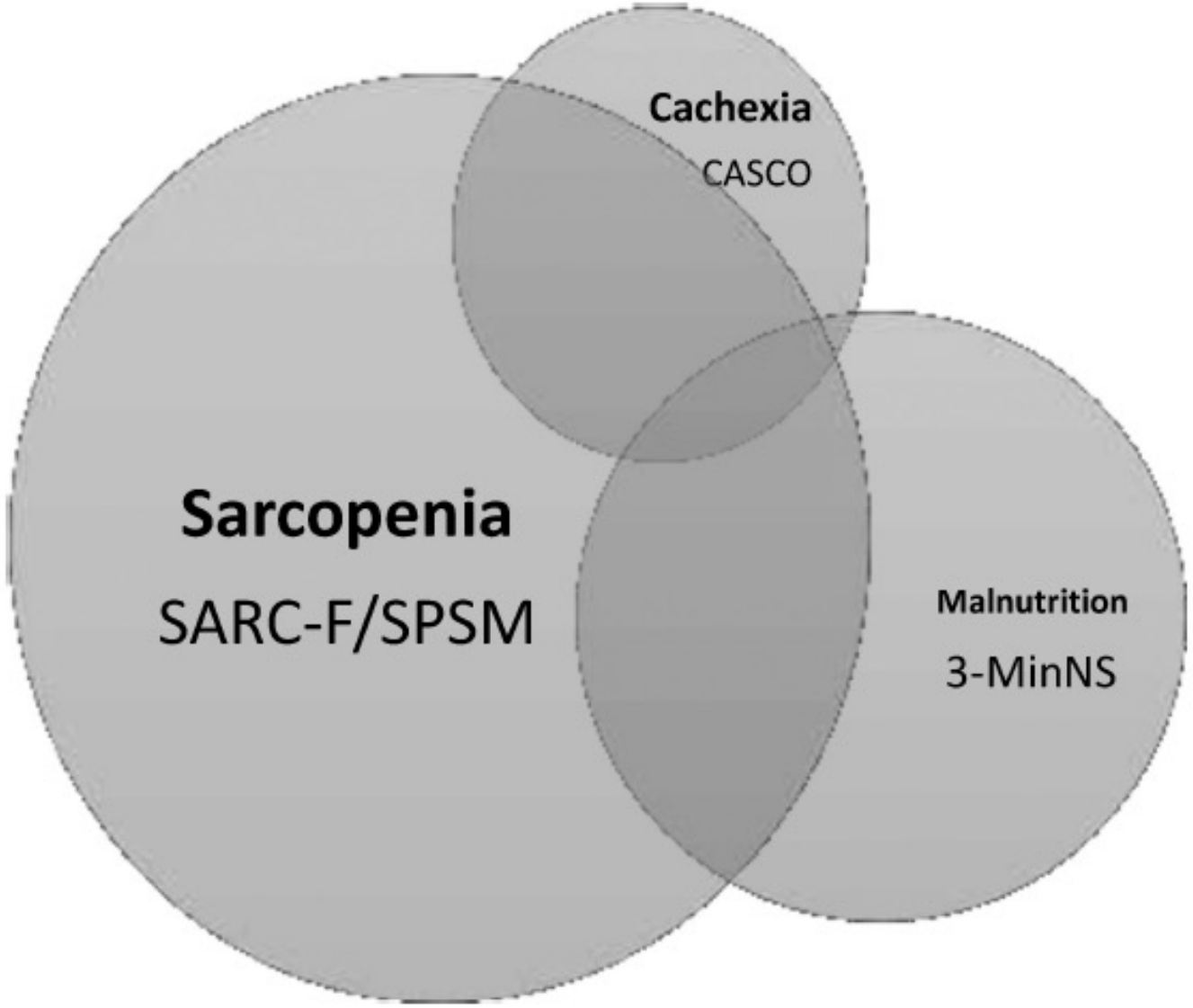


FIGURE 2 Diagram to show overlap between cachexia, sarcopenia, and malnutrition. The sizes of the circles represent the perceived sizes of each clinical problem. CASCO, Cachexia score; SARC-F, Strength, Assistance with walking, Rise from a chair, Climb stairs, and Falls; SPSM, Short Portable Sarcopenia Measure; 3-MinNS, 3-Minute Nutrition Score.

Treatment

Sarcopenia: Resistance training

Adamo ML, et al. Resistance training, and IGF involvement in the maintenance of muscle mass during the aging process. *Ageing Res Rev.* 2006;5:313-31

- Mechanical load can increase cross sectional area of muscle fibers, not fiber numbers characteristic of young muscle
- IGF-1 promotes myoblast proliferation, differentiation, and protein accretion
- Aging muscle may be resistant to IGF-1, an effect that is reversed by exercise.

Sarcopenia; protein supplementation?

- Protein supplementation above adequate levels does not enhance the effect of resistance training on increase or retention of lean body mass.

  (Campbell WW. *Nutr Rev.* 2007;65;416-22)

- “Research has not identified a synergistic effect of protein supplementation and resistance exercise in aging populations

  (Paddon-Jones D et al. *Am J Clin Nutr.* 2008;87(suppl):1562S-1566S.

Chronic disease-related malnutrition and diet

- Anorexia
  - Small frequent meals
  - Drink/sip beverages between meals
  - If possible prioritized high protein/calories foods

  - *Forego food during critical treatment periods*

Pharmacology (anorexia, cachexia)

- Anticytokine agents: presumed affect on cytokine mediated cachexia
- Melatonin
- Omega-3 FA
- Pentoxiphylline
- Thalidomide

Pharmacology (anorexia, cachexia)

- Anabolic agents: do not affect cytokine activity but are used to promote muscle anabolism

- Testosterone derivatives
- Fluoxymesterone
- Nandrolone deconoate
- Oxandrolone

Pharmacology (anorexia, cachexia)

- Appetite stimulants
  - Olanzapine (antipsychotic)
  - Mirtazapine (antidepressive)
  - Dronabinol (cannabinoid)
  - Cyproheptadine (antihistamine)
  - Glucocorticoids
    - Dexamethasone
    - Methylprednisoone
    - Prednisolone
  - Progestational agents
    - Medroxyprotesterone
    - Megastrol acetate

Acute disease-related malnutrition and diet (e.g., critical illness)

- Conservative energy prescription
- 1.5- 2.0 g/kg/day protein
- Mixed lipid sources; hold soy-based lipids parenterally or < 1 g/kg/day
- Parenteral vs enteral vs both
- Timing: early vs late
- *Anti-oxidant supplementation?*
- *Immune stimulating nutrients?*

WHO. *Guidelines: Updates on the management of severe acute malnutrition in infants and children.* Geneva:
World Health Organization; 2013.

- Severe acute malnutrition triaged by presence of bilateral edema and presence of appetite in addition to evidence of a disease process.
- Those children who do not have edema and pass an “appetite test” can be treated at home with a *nutritional* supplement
- Those children with edema etc. (“nutritional edema”) must be brought to clinic to be evaluated for a disease process (inflammation).

Nutrition focused physical exam

Definitions

Bickley LS, Szilagyi PG. *Bates' Guide to Physical Examination and History Taking, 11th Ed.*

- Comprehensive (physical) assessment: does more than assess body systems; includes history taking and personalized knowledge that bonds the clinician/patient relationship
- Focused (physical) assessment: methodologically relevant to the thorough assessment of a target population (probably closer to nutrition focused physical assessment)

Examination versus assessment

- NFPE or NFPA (often used interchangeably)
- Examination is the act of performing a skill
- Assessment is the use of examination result to come to a conclusion: Assessment can also be thought of to be an entire process, from the skill execution to the integration of all known information to come to a conclusion

Historical context

Touger-Decker R. *Top Clin Nutr.* Physical assessment skills for dietetic practice: The past, the present, and recommendations for the future. 2006;21(3):190-8

- Since the 1990s the content of a NFPE has varied, having derived somewhat from nutrition assessment practice in medicine
  - Baker JP, et al. *N Eng J Med.* 1982;306(16):969-72
  - Detsky AS, et al. *JPEN J Parenter Enteral Nutr.* 1987;11(1):8-13
    - Subjective global assessment: includes a section on physical assessment including fat, muscle, and edema evaluations

Description

Touger-Decker R. *Top Clin Nutr.* Physical assessment skills for dietetic practice: The past, the present, and recommendations for the future. 2006;21(3):190-8

PA skills for entry level practice

- Vital signs
  - Pulse, BP
- Head, neck, & oral exam
  - Extra oral, intraoral
  - Recognition of the components of lymph node & cranial nerve exam
- Skin exam
  - Nutrient deficiencies
  - Edema
- Body composition
  - BIA, skin calipers
- Heart and lung sounds
- Abdominal exam

PA skills for adv level practice*

- Vital signs
- Head, neck & oral exam
  - Extra oral, intraoral
  - Cranial nerve exam
  - Lymph node exam
- Heart and lung sounds
- Abdominal exam
- Body composition
  - BIA, skin calipers
- Skin exam
  - Nutrient deficiencies
  - Edema

*Differentiation may be at the level of skill, acuity of patients, and interpretive ability

Techniques

- Inspection
- Palpation
- Percussion
- Auscultation

Inspection

Close observation of the details of the patient's appearance, behavior, and movement such as facial expression, mood, body habitus, conditioning, skin color, edema, etc. In the focused observation use the senses of sight, smell, and hearing

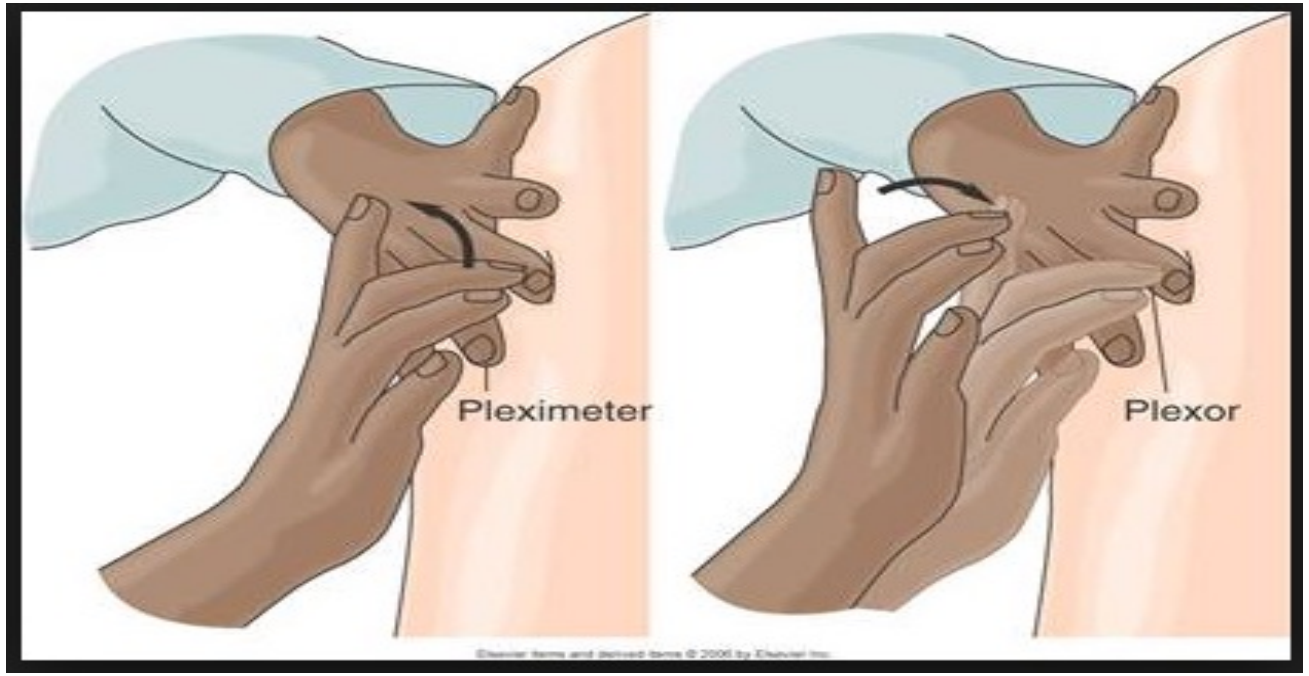
Palpation

Tactile examination to feel pulsations and vibrations. Use he palmar fingers or fingertip pads to assess areas of skin elevation, depression, texture, size, temperature, tenderness, and mobility. Hands should be warm, fingernails clipped. Best for assessing for:

- Edema
- Skin warmth
- Texture
- Tenderness

Percussion

Assessment of sounds to determine body organ borders, shape and position. Use the striking or plexlor finger (usually the third finger in the dominant hand) to deliver a rapid tap or blow against the distal pleximeter finger (usually the third finger on don-dominant hand) laid against the surface of the chest or abdomen to evoke a sound wave from underlying tissue. The sound wave generates a tactile vibration against the pleximeter finger.



Auscultation

Use of the naked ear or the bell (hallow cup) or diaphragm (flat disc)of the stethoscope to listen to body sounds e.g., heart and lung sounds, bowel sounds, blood vessels. The bell transmits low frequency sounds while the diaphragm transmits higher frequency sounds.

Muscle mass, skin, edema

- At the same time (muscle mass and edema)
- Inspection and palpation
- Skin color, traits
  - Turgor, texture, moisture, temperature, lesions
- Head
  - Temporalis, Bichat's fat pad, zygomatic arch, nasolabial skin fold
- Trunk
  - Subclavicular muscle, acromion process, scapula, rib articulation at junction with sternum (loss of subcutaneous adipose tissue).
- Upper extremities, circumference, blood vessel "cabling"
- Upper extremity edema: bilateral, unilateral, pitting?
- Legs
  - Quadriceps mass with knee at right angle,
  - Lower extremity edema: bilateral, demonstrable to?

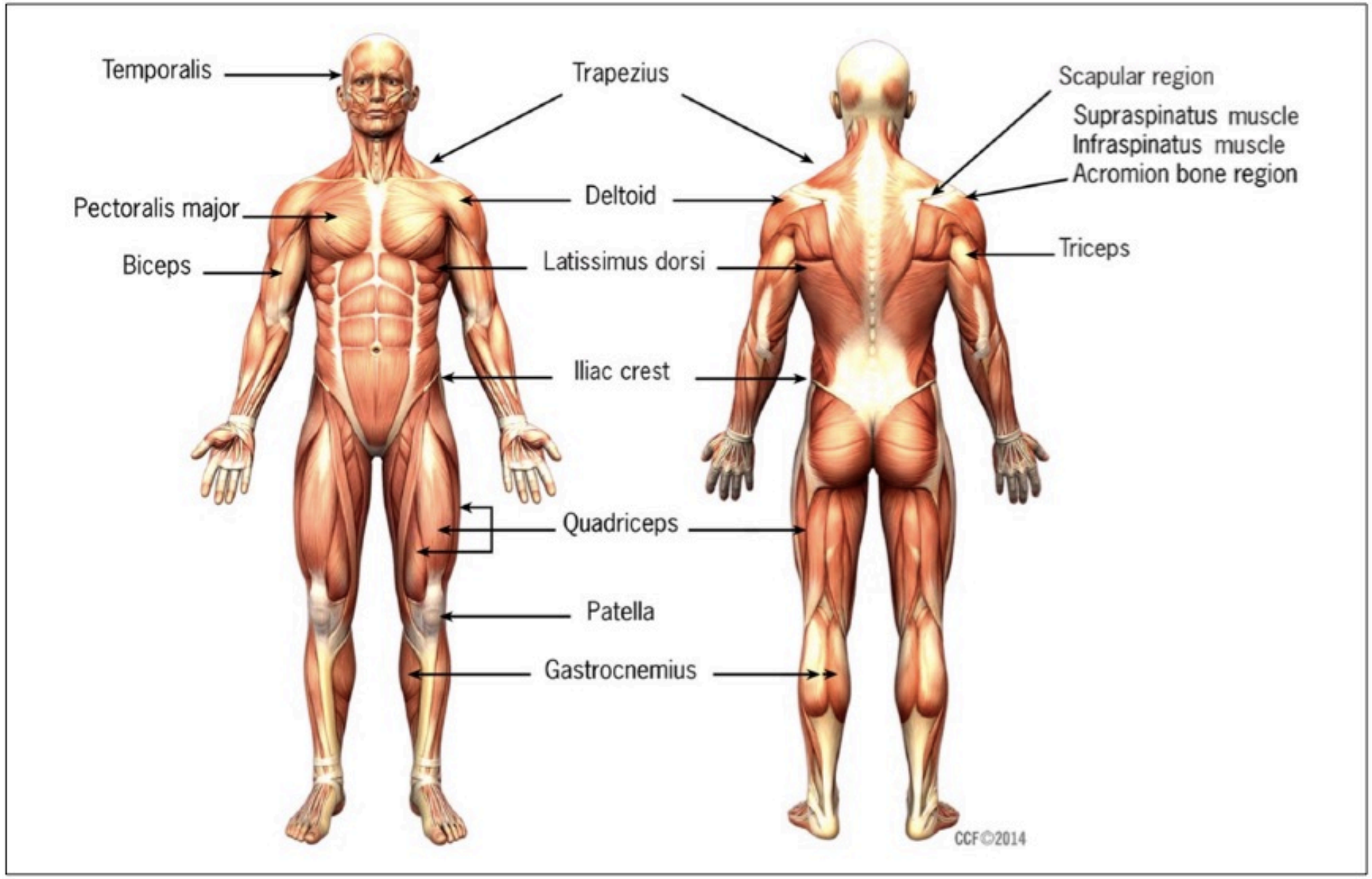


Figure 2. Anterior and posterior muscles commonly used for inspection and palpation during a nutrition-focused physical assessment. Figures also highlighting the scapula and acromion bone regions, which become prominent with greater losses of musculature. Iliac crest, just below the ribcage, is evaluated to assess loss of subcutaneous fat stores. Reprinted with permission from the Cleveland Clinic Center for Medical Art & Photography © 2014. All rights reserved.

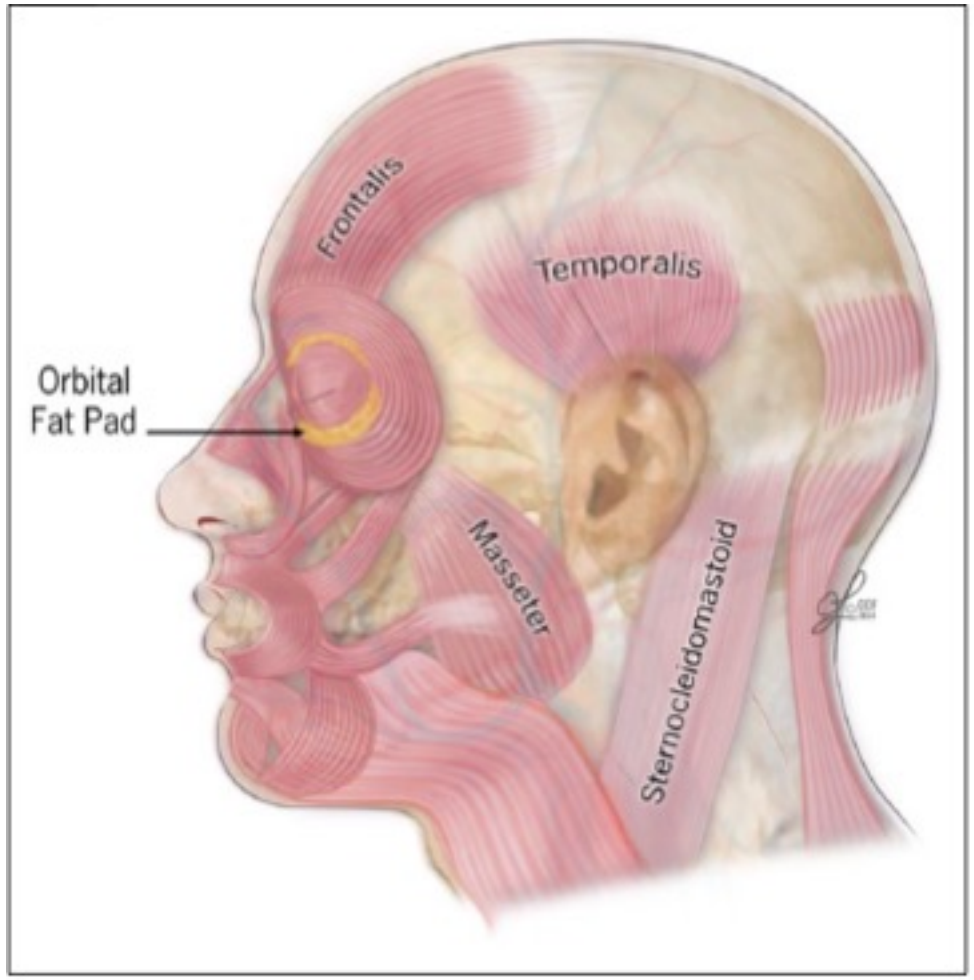
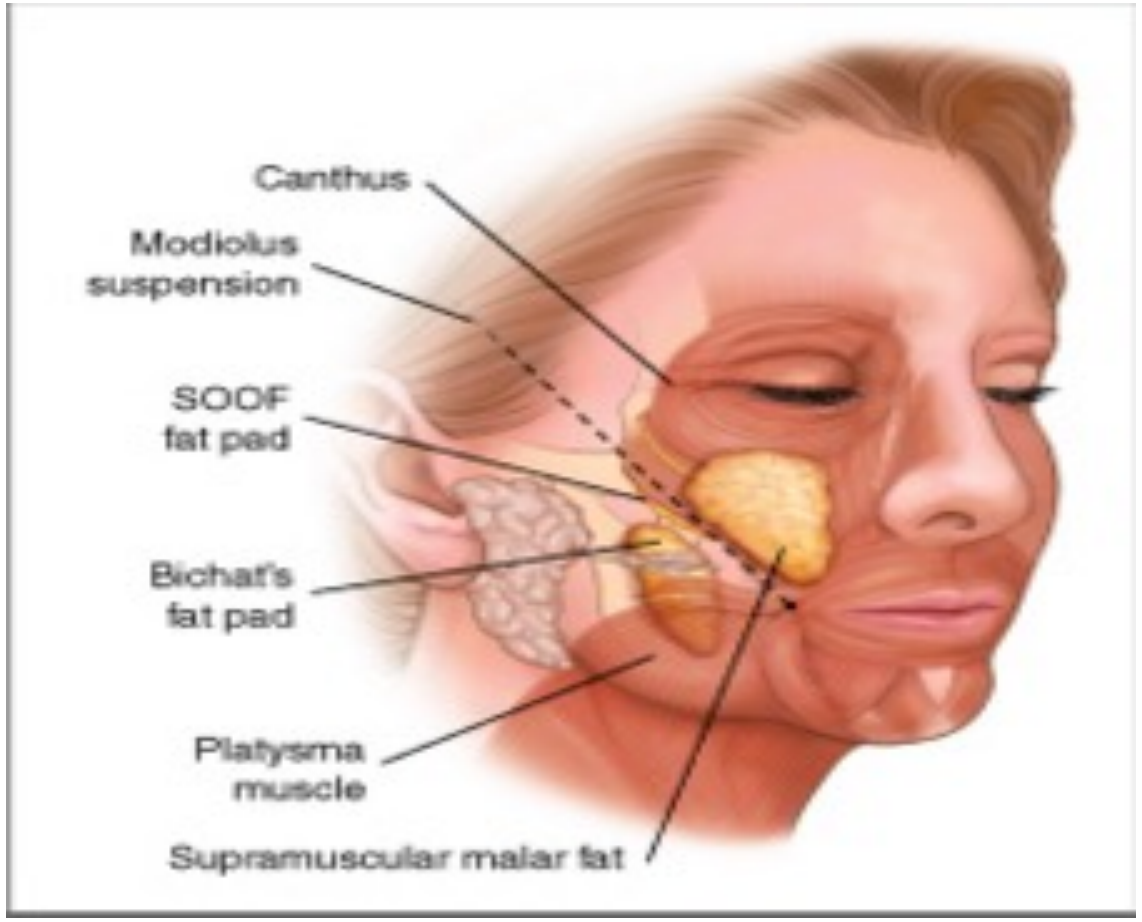
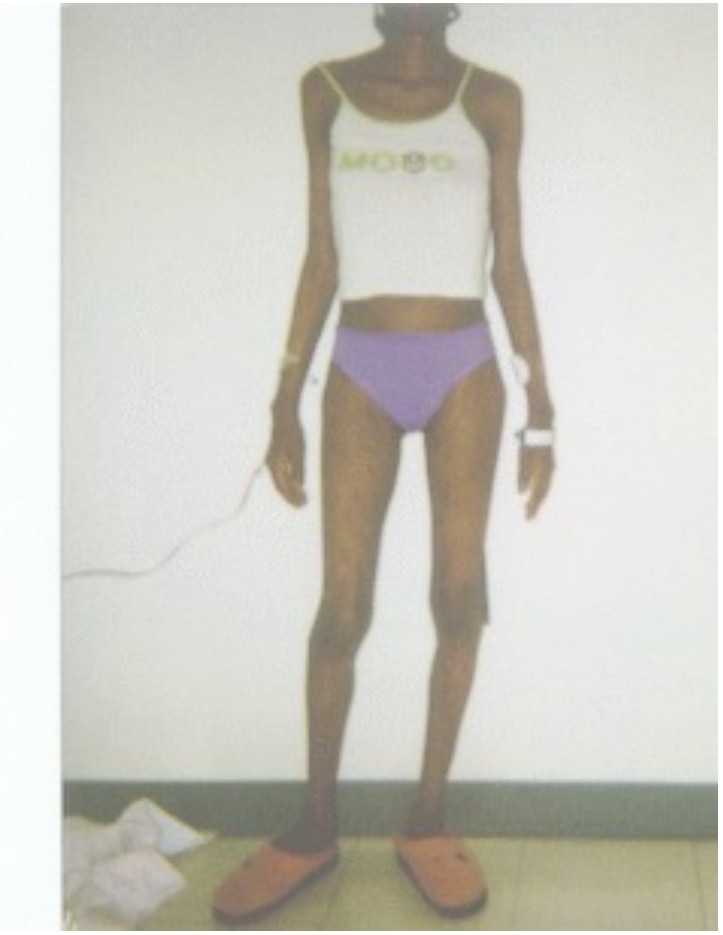


Figure 5. Fat pads and temporalis muscle commonly used for inspection and palpation during a nutrition-focused physical assessment. Figure also highlights a normal fat pad surrounding the eye. Reprinted with permission from the Cleveland Clinic Center for Medical Art & Photography © 2014. All rights reserved.

Bichat’s fat pad

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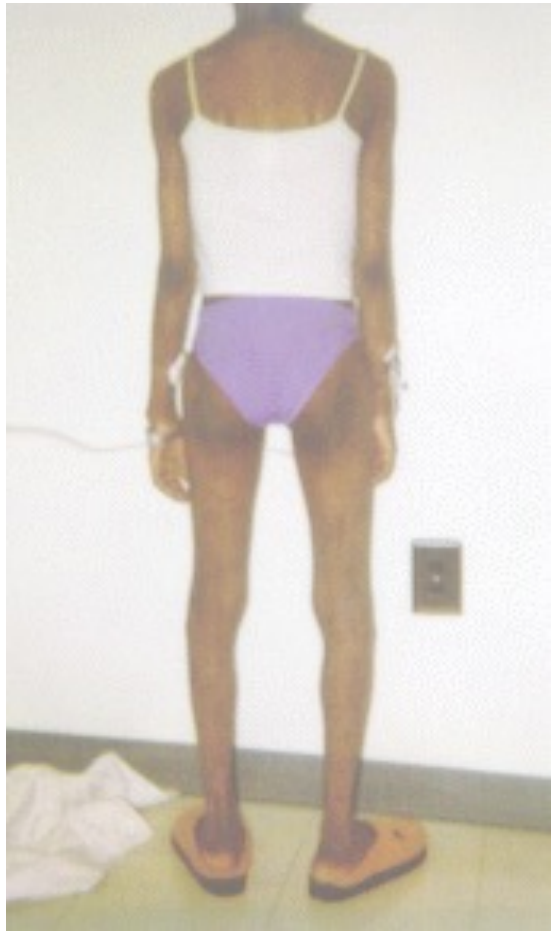
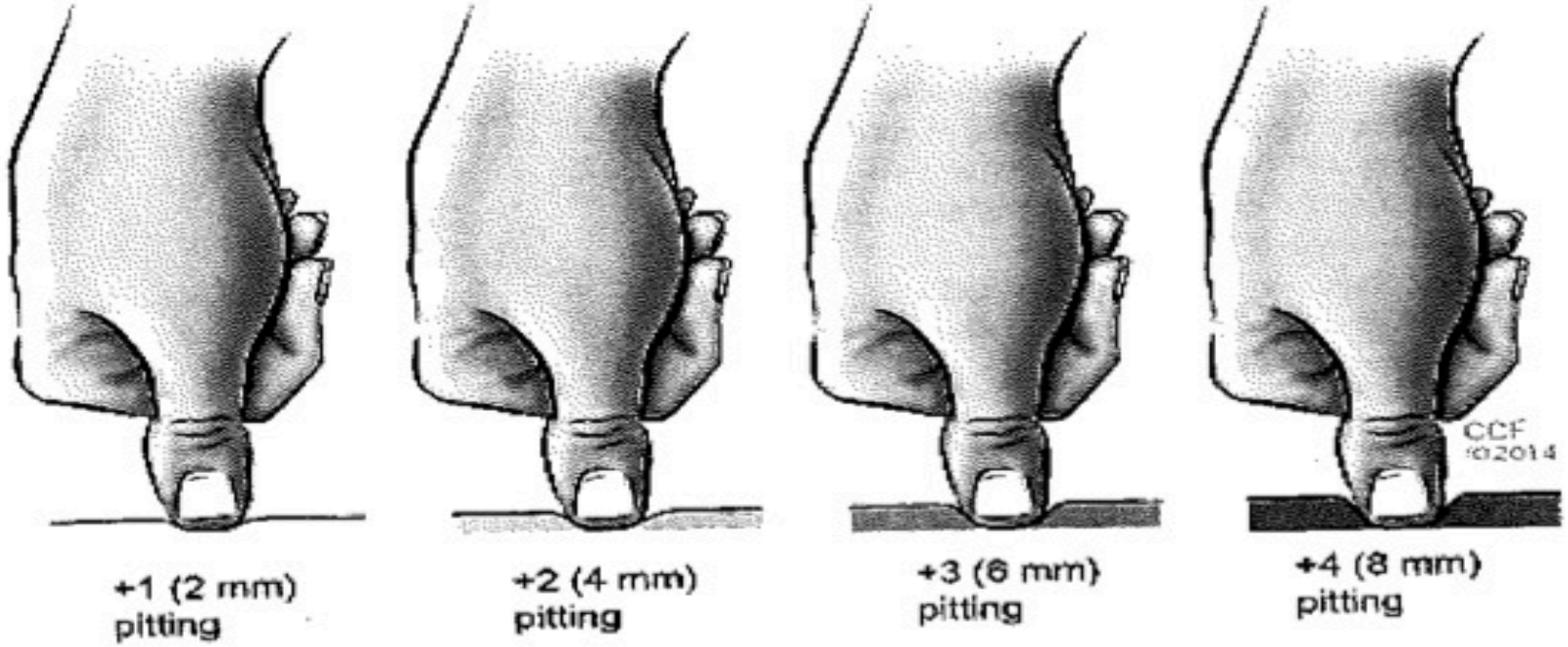


Fluid accumulation (edema) in:

- Brain; cerebra edema
- Eyes; cornel edema, periorbital edema
- Lungs; pulmonary edema, pleural effusion
- Arms and legs; peripheral edema
- Abdomen; ascites
- Genitals; vulvar and scrotal edema
- Feet; pedal edema

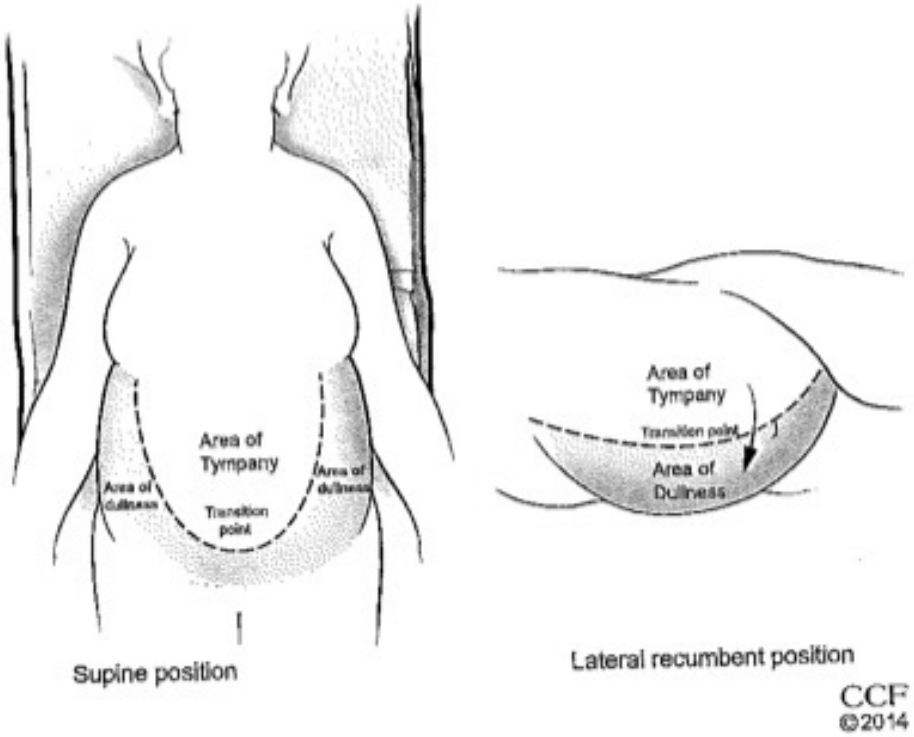
Pitting edema

Figure 3. **Severity grading of pitting edema using pit depth.**



Assessment of ascites

Figure 4. **Assessment of shifting dullness for patients with ascites.**



Application to transplant populations

- Solid organ transplant (cardiopulm, liver, kidney, GI)
- (Bone marrow/stem cell transplants)
  - Pre transplant ablative treatments

- Pre transplant
- Acute post transplant
- Chronic post transplant

Pre transplant

- Organ dysfunction/failure
- Chronic disease-related malnutrition
- Immune and metabolic dysregulation
  - Anorexia
  - Cachexia

Acute post transplant

- Immune and metabolic dysregulation
  - Catabolic metabolism
  - Immunosupressive pharmacology
  - Anorexia
- Acute disease-related malnutrition

Chronic post transplant

- Immunosupression
- Return to normal organ function
- Return to normal anabolic (fed) metabolism
- Increased risk of refeeding syndrome?

Questions/remarks?

Nutrition-Focused Physical Exam and Transplant Nutrition Assessment

Courtney Dunn, MS, RD, CNSC

March 25th, 2021

THE Alliance

Leadership & Engaged Learning in Organ Donation & Transplantation

Disclosure

No disclosures

Objectives

- Explain how to perform the Nutrition-Focused Physical Exam (NFPE)
- Identify muscle and fat losses
- Identify physical signs of micronutrient deficiencies
- Explain how to use the NFPE to identify malnutrition
- Provide effective organ specific nutrition care for transplant patients

Nutrition-Focused Physical Exam

- The Nutrition-Focused Physical Exam (NFPE) is an important component of a thorough nutrition assessment
- Registered Dietitians (RD or RDN) are uniquely qualified to perform the NFPE
- The NFPE is a tool to help RDs identify the presence of and effectively diagnosis the degree of malnutrition
- NFPE is essential to identifying micronutrient deficiencies

Considerations when performing the NFPE

- Ask the patient for consent prior to performing the NFPE
- Ensure privacy
- Practice proper hand hygiene and properly clean shared instruments in between patient interactions
- Communicate abnormal findings to providers

Credit: Centers for Disease Control and Prevention

Components of the Nutrition-Focused Physical Exam

- General Survey
  - Body habitus and BMI
  - Vital signs
- Hair, Skin, and Nails
- Head and Neck
  - Eyes
  - Temples
  - Nose
  - Mouth
- Abdomen

- Upper Body
  - Clavicle
  - Deltoid
  - Scapula
  - Upper Arm
  - Thoracic/Lumbar
  - Interosseous
- Lower Body
  - Anterior Thigh
  - Patellar region
  - Posterior Calf
- Edema
- Neurological

Assessment of Fat Stores

Exam Area	Normal	Mild/Moderate Loss	Severe Loss
Orbital	Fat pads are flat or protrude slightly	• Area around the eye is moderately concave • Faint dark circles	• Area around the eye is very concave • Dark circles • Loose skin
Upper Arm	Skinfold pinch under triceps produces an ample amount of fat tissue	• Skinfold pinch under triceps produces some fat tissue • Finger tips are close together	• Fingers touch with skinfold pinch under triceps • Little to no fat tissue is present
Thoracic/Lumbar	• Ribs are not visible • Iliac crest does not protrude	• Ribs are visible; not marked depressions between them • Iliac crest is visible	• Ribs are protruding; sharp depressions in between ribs • Iliac crest is protruding

Assessment of Fat Stores

Assessment of Muscle Stores

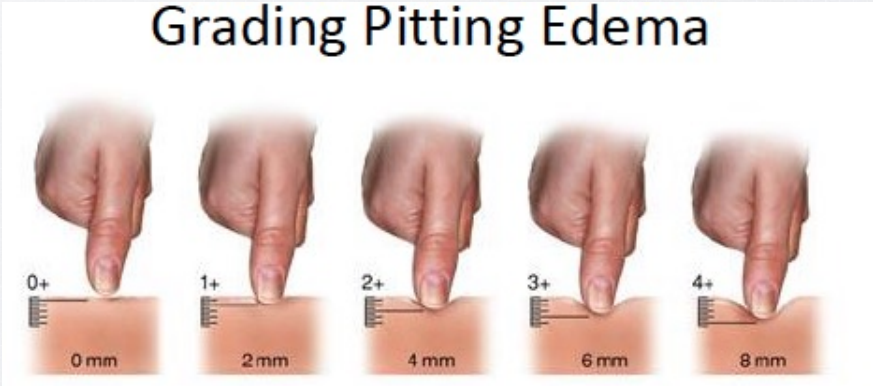
Exam Area	Normal	Mild/Moderate Loss	Severe Loss
Temple	• Temple is easy to see and palpate • Well defined	Temple is slightly depressed	• Temple is depressed and hollow-looking • Facial bones are prominent
Clavicle	• Clavicle is visible in women but not sharply defined • Not visible in men • Pectoralis major is flat or protrudes	• Clavicle is moderately prominent in women • Visible in men • Pectoralis major is diminished	• Clavicle protrudes sharply • Minimal pectoralis muscle
Deltoid	Deltoid is curved around the shoulders and upper arms	Acromion process is more defined	• Deltoid muscle is not palpable around shoulders • Sharply angular
Scapula	• Scapular bones are not prominent • Muscles around the neck base and scapula are not hollowing	• Scapular bones and upper spine are somewhat prominent • Muscles are starting to look hollow	• Scapular bones are sharp and well defined • Muscles are deeply hollowed

Assessment of Muscle Stores

Assessment of Muscle Stores

Exam Area	Normal	Mild/Moderate Loss	Severe Loss
Interosseous	Thumb and interosseous muscles look flat or bulge	Interosseous muscles are slightly depressed	• Bones between thumb and interosseous muscles are prominent • Muscle between thumb and forefinger is concave
Thigh	Muscles are developed and rounded	• May see gap in thigh when knees are pressed together • Inner thigh begins to appear concave	• Muscle have a prominent concave shape in between thighs • Lack definition
Patellar Region	• Patella is not prominent • Muscles around the knee are visible and well-rounded	Patella is slight prominent	• Patella protrudes sharply • Minimal surrounding muscle
Posterior Calf	Muscles are developed and rounded	Muscles are less developed than normal	Muscles are thin and lack definition

Assessment of Muscle Stores



Assessment of Micronutrient Deficiencies

- Skin
  - Examine throughout NFPE
  - Inspect for poor wound healing, edema, rashes, lesions, and turgor
- Hair
  - Assess for texture, distribution, and loss
  - Poor hair quality: Protein, essential fatty acid, zinc, and biotin deficiencies
- Eyes
  - Bitot Spots: vitamin A deficiency
  - Inflammation: vitamin B12, B6, and niacin
- Lips, tongue, and oral cavity
  - Assess dentition, moisture, lesions, and color
- Nails
  - Assess length, color, symmetry
  - Normal nails will have uniform thickness, feel smooth, and adhere to nail beds

Assessment of Micronutrient Deficiencies

Malnutrition Diagnosis and NFPE

- ASPEN/AND Methodology
  - Three etiologies: Acute Illness/Injury, Chronic Illness, and Social/Environmental
    - Moderate and Severe
    - Acute vs Chronic inflammation and without inflammation
  - Six characteristics:
    - Percent weight loss over time
    - Inadequate energy intake
    - **Muscle Loss**
    - **Fat Loss**
    - Fluid accumulation
    - Diminished functional status – measured by handgrip strength

Transplant Nutrition Assessment

- CMS requires transplant programs to make nutrition assessments, performed by a dietitian, available to all patients undergoing transplant or living donation
- Malnourished patient prior to transplant tend have increased rate of post-transplant mortality and morbidity, and longer hospital length of stay compared to well-nourished patients
- A transplant nutrition assessment includes nutrition, medical, medication history; labs, and anthropometrics, and the nutrition-focused physical exam

Transplant Nutrition Goals

Each phase of transplant has specific nutrition goals:

- Pre-Transplant Phase: optimize patient's nutrition status to undergo transplant surgery
  - Identify and treat malnutrition
  - Utilize nutrition support
- Acute Post-Transplant Phase: provide adequate nutrition to replete lost nutrient stores and heal surgical wounds, prevent infection, and help manage medication side effects
- Chronic Post-Transplant Phase: ensure adequate nutrition intake and help manage any long-term complications like obesity, diabetes mellitus, hypertension, hyperlipidemia, and osteoporosis

Organ Specific Nutrition Care

Post-Transplant Diet Considerations

- Management of medication side effects
  - Steroids: management of elevated blood glucose levels, wound healing, bone health, hypertension, hyperlipidemia, and weight gain
  - Tacrolimus and cyclosprine: elevated potassium, magnesium wasting
- Food-Drug interactions with immunosuppression
  - Grapefruit, pomegranate, seville oranges, and stat fruit
- Food safety

Credit: Centers for Disease Control and Prevention

Organ Specific Nutrition Care

Kidney Transplant

- Malnutrition can be found in 40-70% of patients with ESRD
- Protein energy wasting is a result of multiple factors:
  - Anorexia, protein and nutrient loses during HD, and catabolism from chronic disease
- Body weight and BMI might not be accurate due to fluid retention
  - DEXA scan can be used to determine body composition
- Pre-Transplant considerations:
  - Electrolyte restricted diet
  - Estimated needs
    - 30-35 kcal/kg of dry weight or IBW for obesity
    - 1.2-1.5 gm protein/kg dry weight or IBW while on HD; 1.2 gm protein/kg for PD
    - 0.6-0.8 gm protein/kg dry weight or IBW for nondialysis CKD
    - UOP+ 500 mL – 1000 mL while on HD

Organ Specific Nutrition Care

Kidney Transplant

- Patients are at risk for vitamin C, vitamin B6, folic acid, vitamin D, and iron deficiency
  - Renal MVI daily
  - Supplement low vitamin D levels
- Post-Transplant considerations:
  - Liberalized diet based on organ function
  - Long-Term estimated needs:
    - 25-30 kcal/kg and 0.8-1.0 gm protein/kg

Organ Specific Nutrition Care

Liver Transplant

- Pre-Transplant considerations:
  - Malnutrition is common in patients awaiting liver transplant
  - Potential causes malnutrition: inadequate po intakes due to anorexia and early satiety from ascites, malabsorption, and decreased fat absorption
  - Vitamin A, B6, B12, thiamine, folate, magnesium, and zinc levels can be decreased in patients awaiting liver transplant; copper level may be increased with Wilson's disease
  - Pre-Transplant considerations:
    - Sodium restricted, carbohydrate controlled, high protein diet
    - Small, frequent meals + bedtime snack with protein
    - Use oral nutrition supplements or enteral nutrition as indicated

Organ Specific Nutrition Care

Liver Transplant

- Estimated needs pre-transplant:
  - 25-30 kcal/kg dry weight or IBW for maintenance; up to 35 kcal/kg for repletion
  - 1-1.5 gm protein/kg dry weight or IBW; up to 2 gm protein/kg for repletion
  - Fluid restriction if hyponatremic
- Post-Transplant considerations:
  - Continue sodium restricted, carbohydrate controlled, high protein diet as patient is healing from transplant
  - Continued use of oral nutrition supplements or enteral nutrition
  - Estimated needs:
    - 30-35 kcal/kg dry weight or IBW
    - 1.2-1.5 gm protein/kg dry weight or IBW; up to 2 gm/kg for repletion
    - Long-Term: 25-30 kcal/kg and 0.8-1.0 gm protein/kg

Organ Specific Nutrition Care

Heart Transplant

- Anorexia and nausea associated with heart failure can lead to malnutrition that causes cardiac cachexia and loss of muscle in heart
  - Reduced blood flow to the gut can cause delayed gastric emptying
  - Edema of the bowel and stomach can decrease appetite
- Pre-Transplant considerations:
  - Sodium restricted diet
  - Small, frequent meals if patient experiences early satiety
  - Oral nutrition supplements as needed
  - Estimated needs
    - 25-30 kcal/kg dry weight or adjusted weight for maintenance; up to 35 kcal/kg for repletion
    - 1.1-1.3 gm protein/kg dry weight or IBW
    - Fluid restriction if hyponatremic
  - Thiamine supplementation if deficient

Organ Specific Nutrition Care

Heart Transplant

- Post-Transplant considerations:
  - Continue sodium restricted, high protein diet as patient is healing from transplant
    - Encourage consistent carbohydrate intake if BG levels become difficult to control
  - Continued use of oral nutrition supplements or enteral nutrition as indicated
  - Estimated needs:
    - Calorie needs: 30-35 kcal/kg dry weight or IBW
    - Protein needs 1.2-1.5 gm protein/kg dry weight or IBW; up to 2 gm/kg for repletion
    - Long-Term: 25-30 kcal/kg and 0.8-1.0 gm protein/kg

Organ Specific Nutrition Care

Lung Transplant

- Malnutrition can be found in up to 60% of inpatients with COPD
  - Causes of malnutrition: hypermetabolism from increased work of breathing, anorexia from hypoxemia, and early satiety
- Malnutrition in cystic fibrosis is likely caused by hypermetabolism, malabsorption, and pancreatic insufficiency
- Pre-Transplant considerations:
  - High calorie, high protein diet in patients with cystic fibrosis or severe malnutrition
  - Oral nutrition supplements and enteral nutrition as indicated
  - Small, frequent meals
  - Estimated needs
    - 25-30 kcal/kg dry weight or adjusted weight for maintenance; up to 35 kcal/kg for repletion
    - CF patients will require 120-150% of estimated requirements for the general population; BMI goal 22 for female and 23 for males
    - 1.0-1.2 gm protein/kg dry weight or IBW

Organ Specific Nutrition Care

Lung Transplant

- Fat soluble vitamin (A, D, E, and K) supplementation and use of pancreatic enzymes as needed for patients with cystic fibrosis
- Calcium and vitamin D supplementation as needed for patient on chronic steroids prior to transplant
- Post-Transplant considerations:
  - Continue high calorie, high protein diet as patient is healing from transplant.
  - Add sodium and consistent carbohydrate restriction as needed
  - Continued use of oral nutrition supplements or enteral nutrition to meet estimated needs
  - Maintain aspirations precautions
  - Estimated needs:
    - 30-35 kcal/kg dry weight or IBW for repletion
    - 1.2-1.5 gm protein/kg dry weight or IBW; up to 2 gm/kg for repletion
    - Long-Term: 25-30 kcal/kg and 0.8-1.0 gm protein/kg

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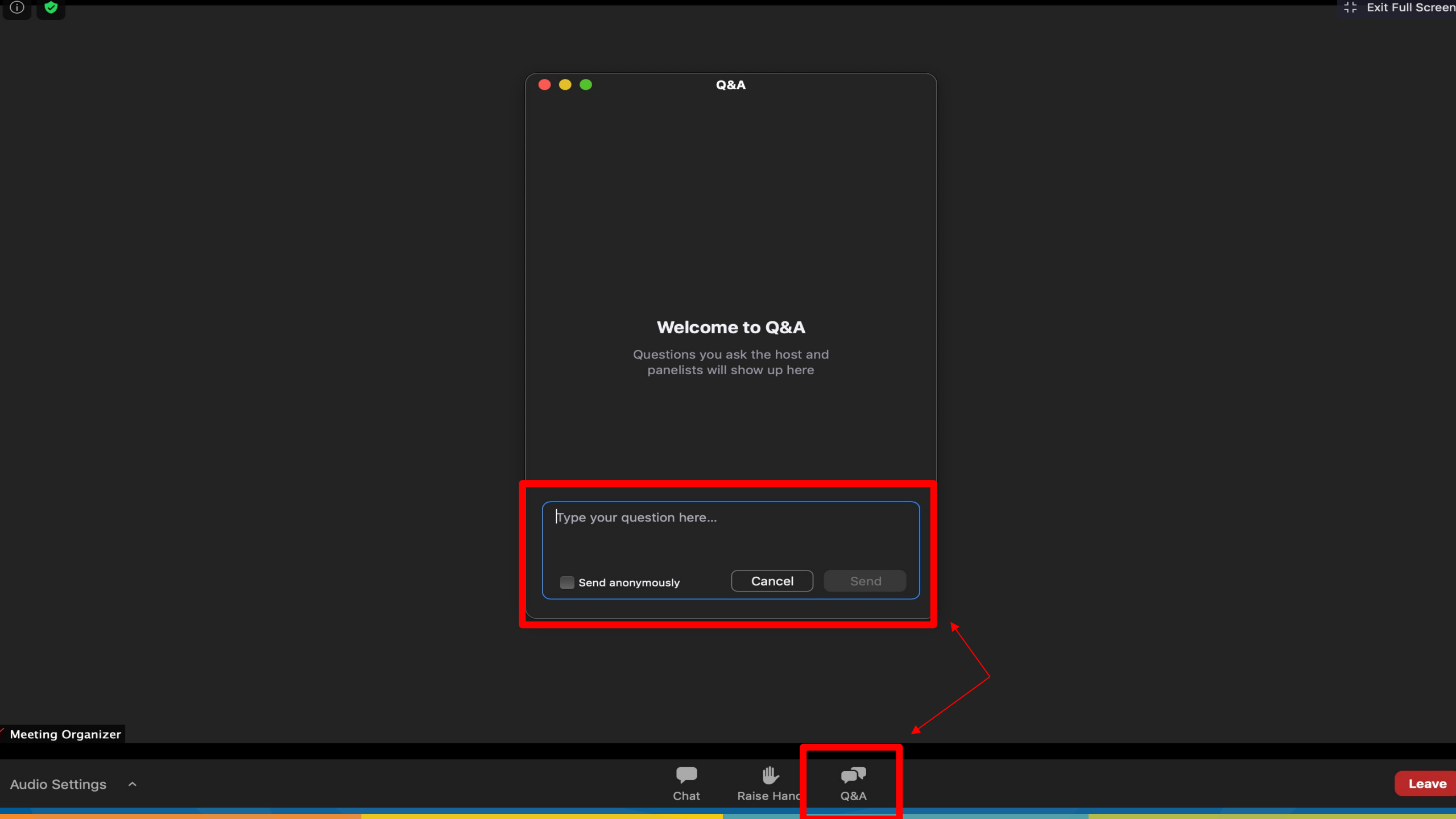
Questions?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Thank You!