Utilizing Non-Pharmacologic Interventions to Improve Outcomes in Advanced Heart Disease

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Disclosures

- None

Objectives

- 1. Compare and contrast non-pharmacological interventions to improve the health of critically ill patients with advanced cardiac disease
- 2. Define the impact of diet and malnutrition (including obesity) on the heart transplant candidate and recipient

Diagnosing and recognizing Malnutrition in the Acute Care Setting

- Traditional Nutrition Markers
  - Malnutrition
  - Inflammation
  - Cardiac Cachexia
  - Thiamine
- Subjective Global Nutrition Assessment and Nutrition Focused Physical Assessment
  - Obstacles with Physical Assessment in the Heart Failure Population
  - Sarcopenia

Nutrition Intervention in the Heart Transplant Candidate

- Obstacles and solutions in the acute care setting for the malnourished patient
  - NPO
  - Calorie/Protein deficit
  - Early enteral nutrition
  - Volume
- Obstacles and solutions in the acute care setting for the obese patient
  - Sarcopenic Obesity
  - Estimating needs

Malnutrition

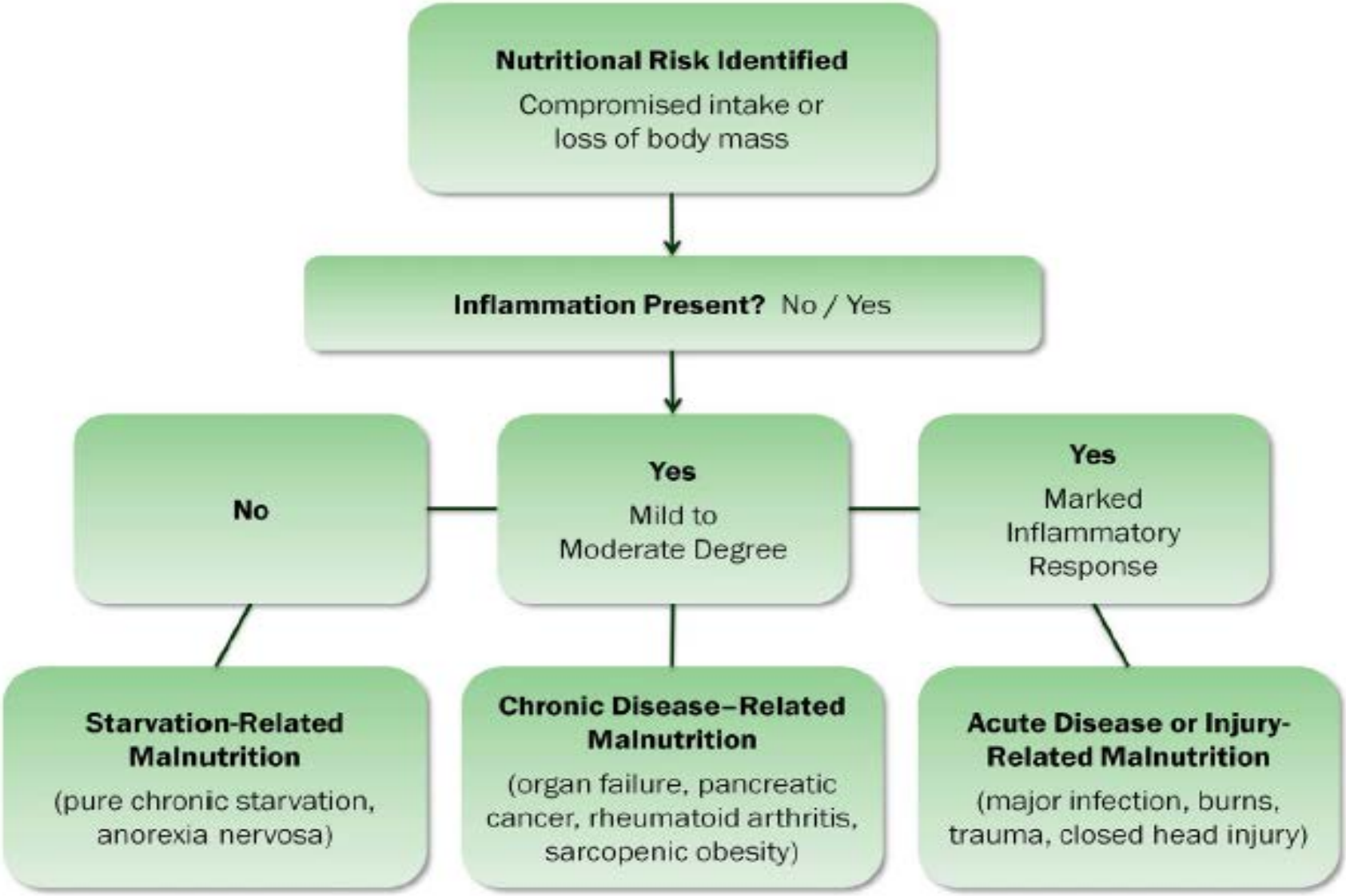
- What do we use to diagnose malnutrition?
  - Weight loss
    - 5% weight loss in 1 month
    - 10% weight loss in 3 months
    - 15% weight loss in 6 months
    - BMI < 18.5
    - < 90% IBW
- Inadequate energy intake
- Loss of muscle and fat mass
- Fluid accumulation
- Decreased Hand grip strength

Inflammation

- What are some of the characteristics of inflammation?
- Insulin resistance
- Increase in the oxidation of lipids
- Increase in protein breakdown
- Decrease in muscle and fat stores
- Increase in tumor necrosis factor
- Increase in interleukin (12-1) 12-6
- Increase in CRP
- Increase in fibrinogen
- Decrease in prealbumin, albumin, cholesterol and other traditional nutrition markers

Inflammation

- Hypothermia
- Increased risk of infection
- Fever
- Decrease in platelet counts
- Negative nitrogen balance



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Cardiac Cachexia

- Patients may stay the same weight but have marked protein loss, fat loss and bone loss
- Weight may be replaced by fluid
- Patients have increased plasma levels of norepinephrine, epinephrine, cortisol, aldosterone and cytokines
- Patients may also be deficient in B-vitamins necessary for metabolism due to drug therapy and possibly due to the inflammatory response of the disease
- It can be observed via temporal wasting and muscle wasting
- Dietary intake of protein and calories are important as well as supplementation of deficiencies as needed
- Fish oil supplementation may benefit this patient population
- Supplementation of taurine, coenzyme Q10, carnitine, thiamine, creatine, vitamin E, vitamin C and selenium have shown increased myocardial levels

Cardiac Cachexia Pathophysiology and Clinical Implications Wolfram Steinborn(1) and Stefan D. Anker *Basic Appl Myol 13 (4): 191-201, 2003*
The management of conditioned nutritional requirements in heart failure Marc L. Allard et al Heart Fail Rev (2006) 11:75–82 DOI 10.1007/s10741-006-9195-3

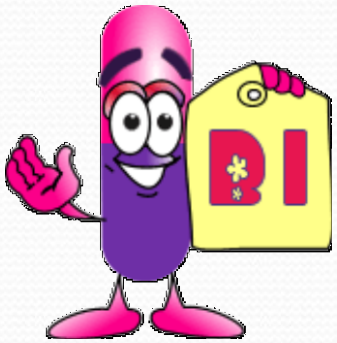
Cardiac Cachexia

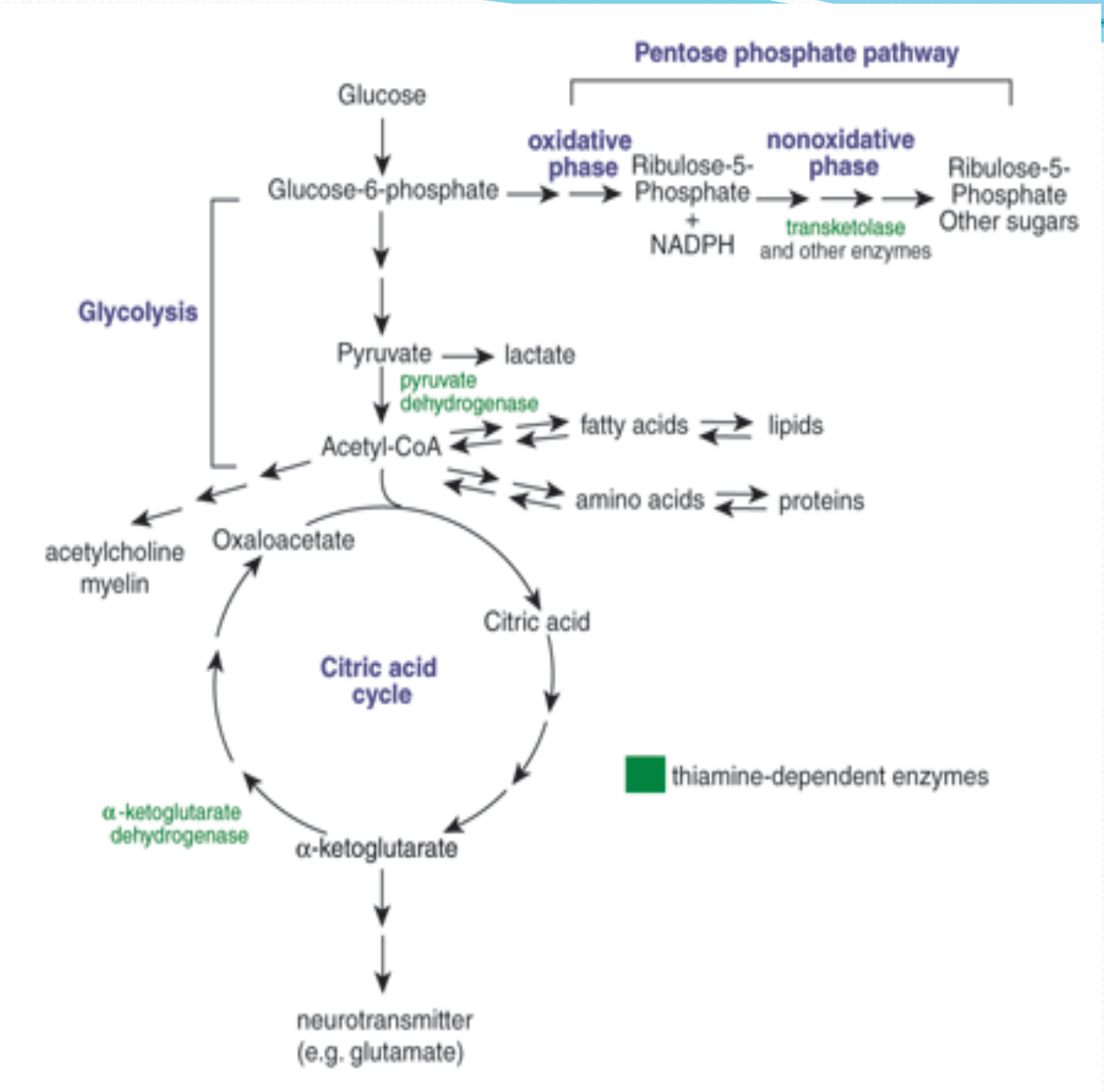
Cardiac Cachexia

- Do not restrict cholesterol or fat in this population
- Sometimes sodium restriction can be omitted as the patient is not eating enough
- Protein needs can be increased and supplementation and sometime additional tube feedings can be given to promote anabolism

Thiamine

- Common deficiency found in patients on loop diuretics
- Plays an important roll in metabolism
- Supplement as needed in the acute care setting
- Other common deficiencies includes Vitamin D




Pentose phosphate pathway
Glucose
oxidative phase
Ribulose-5-Phosphate
+
NADPH
nonoxidative phase
transketolase and other enzymes
Ribulose-5-Phosphate
Other sugars
Glucose-6-phosphate
Glycolysis
Pyruvate
lactate
pyruvate dehydrogenase
Acetyl-CoA
fatty acids
lipids
amino acids
proteins
acetylcholine
myelin
Oxaloacetate
Citric acid
Citric acid cycle
thiamine-dependent enzymes
α-ketoglutarate dehydrogenase
α-ketoglutarate
neurotransmitter
(e.g. glutamate)

SGA Nutrition Assessment

- Diagnosis
- Diet History (decrease in appetite, n/v, early satiety)
- Physical signs and symptoms
- Significant weight loss
- Anthropometric Measurements
- Labs
- Estimated needs

Table 6. Specific Areas to Assess for Subcutaneous Fat Loss.

Exam Areas	Tips	Severe Malnutrition	Mild-Moderate Malnutrition	Well Nourished
Orbital Region – Surrounding the Eye	View patient when standing directly in front of them, touch above the cheekbone	Hollow look, depressions, dark circles, loose skin	Slightly dark circles, somewhat hollow look	Slightly bulged fat pads. Fluid retention may mask loss
Upper Arm Region: Triceps/biceps	Arm bent, roll skin between fingers, do not include muscle in pinch	Very little space between folds, fingers touch	Some depth pinch, but not ample	Ample fat tissue obvious between folds of skin
Thoracic and Lumbar Regions: Ribs, Lower back, Midaxillary line	Have patient press hands hard against a solid object	Depression between ribs very apparent. Iliac Crest very prominent	Ribs apparent, depressions between them less pronounced. Iliac Crest somewhat prominent	Chest is full; ribs do not show. Slight to no protrusion of the Iliac Crest

Table 8. Assessment of Edema.

1+	2 mm depression, barely detectable Immediate rebound
2+	4mm deep pit A few seconds to rebound
3+	6 mm deep pit 10-12 seconds to rebound
4+	8 mm: very deep pit >20 seconds to rebound

Table 7. Specific Areas to Assess for Muscle Loss.

Exam Area	Tips	Severe Malnutrition	Mild-Moderate Malnutrition	Well Nourished
Temple Region: Temporalis Muscle	View patient when standing directly in front of them, ask patient to turn head side to side	Hollowing, scooping, depression	Slight depression	Can see/feel well defined muscle
Clavicle Bone Region: Pectoralis Major, Deltoid, Trapezius Muscles	Look for prominent bone. Make sure patient is not hunched forward	Protuding, prominent bone	Visible in male, some protrusion in female	Not visible in male, visible but not prominent in female
Clavicle and Acromion Bone Region: Deltoid Muscle	Patient arms at side: observe shape	Shoulder to arm joint looks square, bones prominent; acromion protrusion very prominent	Acromion process may slightly protrude	Rounded, curves at arm/shoulder/neck
Scapular Bone Region: Tapezius, Supraspinus, Infraspinus Muscles	Ask patient to extend hands straight out, push against solid object.	Prominent, visible bones, depressions between ribs/ scapula or shoulders/ spine	Mild depression or bone may show slightly	Bones not prominent, no significant depressions
Dorsal Hand: Interosseous muscle	Look at thumb side of hand; look at pads of thumb when tip of forefinger touching tip of thumb	Depressed area between thumb–forefinger	Slightly depressed	Muscle bulges, could be flat in some well nourished people
Lower body less sensitive to change				
Patellar Region: Quadricep Muscle	Ask patient to sit with leg propped up bent at knee	Bones prominent, little sign of muscle around knee	Knee cap less prominent, more rounded	Muscles protrude, bones not prominent
Anterior Thigh Region: Quadricep Muscles	Ask patient to sit prop leg up on low furniture; grasp quads to differentiate amount of muscle tissue from fat tissue.	Depression/line on thigh, obviously thin	Mild depression on inner thigh	Well rounded, well developed
Posterior Calf Region: Gastrocnemius Muscle	Grasp the calf muscle to determine amount of tissue	Thin, minimal to no muscle definition	Not well developed	Well-developed bulb of muscle

Physical Assessment in Heart Failure

- Muscle
  - Temporal
    - Severe deep hollow scooping
    - Moderate to mild slightly hollow/depressed
    - Visible muscle
  - Clavicle
    - Severe deep visible bone
    - Mild to moderate for Males visible and some depth in females
    - Adequate will no be visible in a male and visible but not protruding in females
  - Dorsal Hand
  - Hand grip Less than 80% for age and gender

Fat

- Fat
  - Triceps
    - Severe almost no space between fingers
    - Moderate to mild pinch will be more significant
    - Well nourished ample
  - Orbital
    - Severe Hollowed depressed look, loose skin, and dark circles
    - Mild to moderate slightly hollowed depressed look and dark circles

Physical signs and symptomes

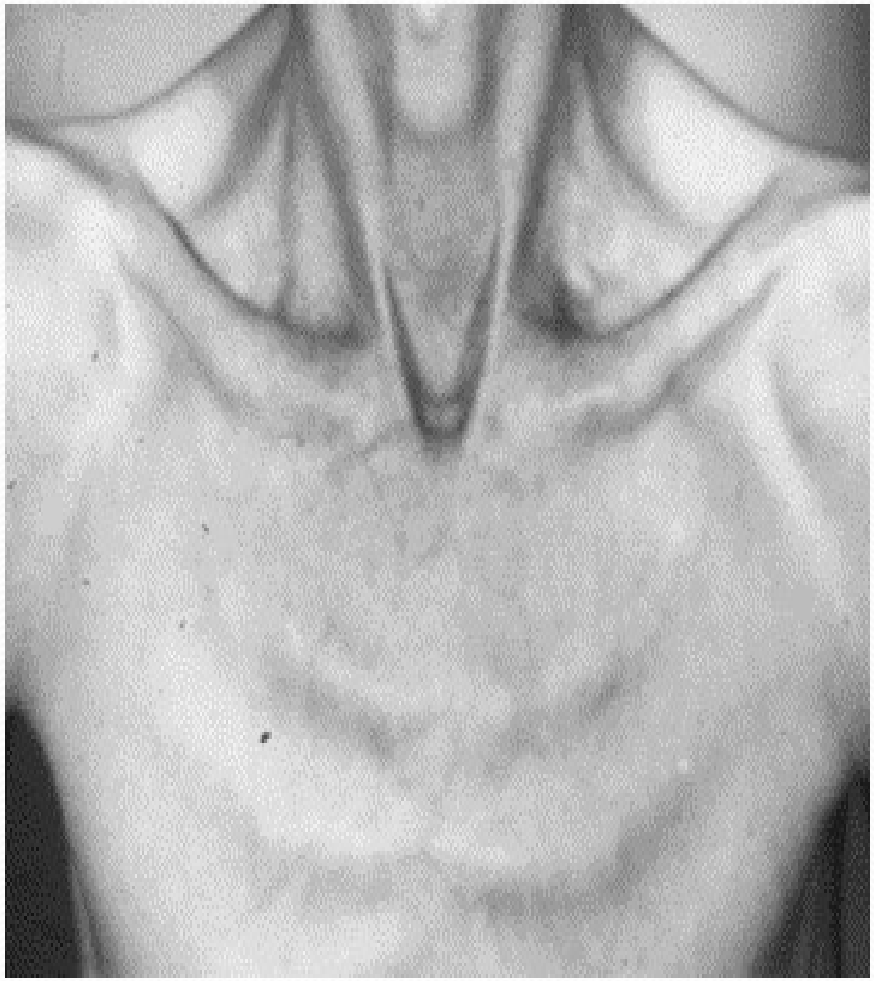
- Muscle and fat stores
- Edema: face, feet hands, abdomen
- Temporal Wasting
- Teeth
- Skin and hair
- Sarcopenic Obesity high fat weight vs lean body mass

Orbital Region

Temporalis Muscle

- Severe

Clavicle



Sarcopenia

- Sarcopenia is defined as the loss of muscle mass in the natural process of aging
- Sarcopenia in kidney and liver patients has been shown to increase waitlist mortality, increased risk of infection and an increase in mortality and graft loss
- Sarcopenic Obesity is defined as decrease in lean muscle mass in the presence of fat stores
- Sarcopenia has also been shown to be an increase in mortality and surgical complications in general surgery and cardio-thoracic population as well.

Estimating caloric needs

- Predictive equations
  - Harris Benedict 27-50% vs metabolic cart
  - Mifflin St Jeor 29-54% vs metabolic cart
  - Penn State 53-77% vs metabolic cart
- Metabolic cart inaccuracies
  - CVVHD/HD
  - Chest tubes (air leaks)
  - Room O2
  - Feedings should be stable for 12 hours
  - Pain medications and pain
  - Consistent ventilation FIO2
  - Must achieve a steady state

Energy/Protein Needs

- For a BMI less than 30 use CBW (current body weight)
- Increased in sepsis, CVVHD, HD, critical care, wound healing
- Total Protein should not be decreased with azotemia in renal failure pre-dialysis

Expert consensus

- Early EN should be started on obese patients
- Obese patients should be assessed based on biomarkers of metabolic syndrome, comorbidities and level of inflammation
- Obese patients should also focus on evidence of central adiposity, metabolic syndrome, sarcopenia, SIRS, and BMI >40 or other comorbidities that put them at higher risk for CVD and mortality
- High protein hypo-caloric feedings should be used in the obese population
- Obese patients should be fed 65-70 of IC and if not available use 11-14 kcals/kg Actual BW (BMI 30-50), 22-25 kcals/kg IBW per day with patients with BMI >50
- Protein should be given in obese as 2.0 gms/kg IBW for patients BMI 30-40 and 2.5 gms /kg IBW in BMI >40

General Energy and Protein needs

Nutrient	Acute Care	Critical Care
Energy		
Maintenance	25-30 kcals/kg/day	25-27 kcals/kg/day
Refeeding	15-25 kcals/kg/day	15-25 kcals/kg/day
Protein		
maintenance	0.8-1.0 gms/kg/day	1.5-2.2 gms/kg/day
catabolism	1.2-2.0 gms/kg/day	1.5-2.2 gms/kg/day
Dextrose	< 7 g/kg/day	<5 g/kg/day
Lipid	< 2.5 g/kg/day	0.4-0.75 g/kg/day

NPO

Calorie and protein deficit

- When a goal rate for tube feeding is given at 75 ml per hour typical intake to a patient can be estimated to a rate of 50-60 ml per hour
- Mortality can be decreased by 41-61% by providing 100% of estimated protein needs in patients in comparison to patients that receive less than 75%
- So with patients being NPO often and feedings being turned off through the day higher goal rates may be required or a volume based feeding protocol.

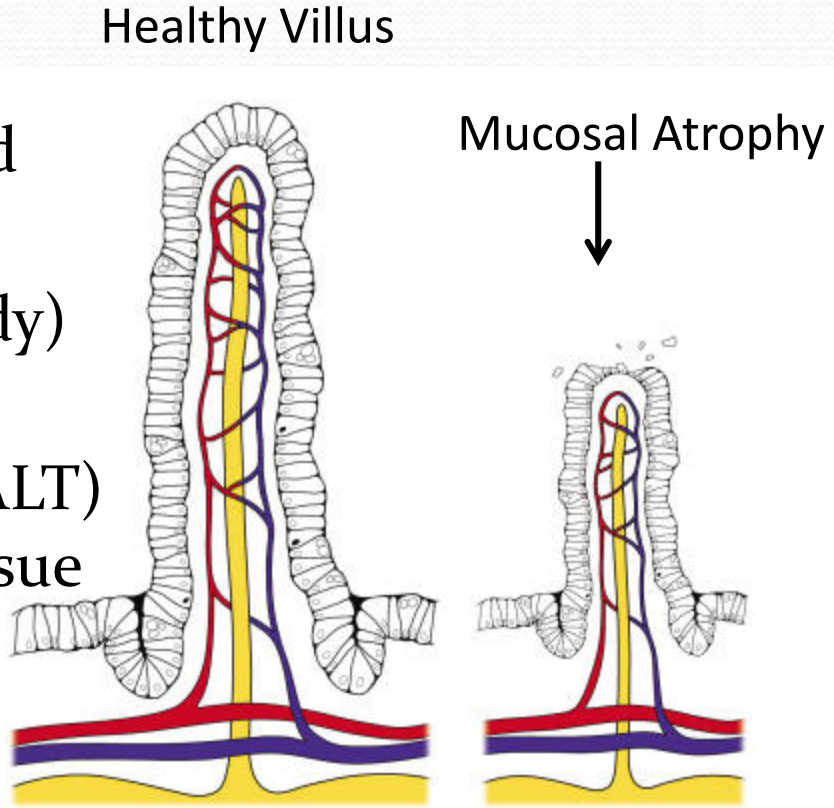
Graded Guidelines

- High protein provision should be given 1.2-2.0 gms/kg in the ICU (actual body weight) and likely higher in burn (very low)
- Don't check gastric residuals and if you do check gastric residuals do not hold for less than 500 ml (low)
- Enteral feeding protocols should be implemented to increase calories provided (moderate to high)

Benefits of Early Enteral Nutrition

Maintains gut integrity & reduces risk for systemic infections

- Prevents mucosal atrophy of
- Reduces bacterial overgrowth and translocation
- Stimulates secretory IgA (antibody)
- Supports mass of gut-associated lymphoid tissue (GALT) and (MALT) mucosal-associated lymphoid tissue



Reference: McClave S. A. & Heyland D.K, Nutr Clin Pract , 2009

Reference: Perioperative Nutrition What is the Current Landscape Martindale et al JPEN Sept 2013

Early Enteral Feeding meta-Analyses

- Marik, *CCM* 2001 (medical ICU patients) Feeding < or > 36 hr 15 studies, 753 patients
- Lewis, BMJ 2001 (surgery patients) NPO vs. <24 hr 11 studies, 837 patients
- Heyland JPEN 2003 (medical ICU patients) <24-48 hr 8 studies
- Lewis SJ, J GI Surg 2008 (surgery patients) <24 hr 13 studies 1173 patients
- Doig, GS, Int Care Med 2009 (critically ill patients) <24 hr 5 studies
- Osland E JPEN 2011 (GI surgery with resection) <24 hr 15 studies 1240 patients
- Doig GS, Injury 2011 (trauma patients) <24 3 studies

↓ **LOS and Infection**

↓ **LOS and Infection**

↓ **Trend towards infection and mortality**

↓ **Mortality**

↓ **Infection and mortality**

↓ **45% decrease in mortality (and no increase in anastomotic leak)**

↓ **Mortality and LOS**

Enteral Nutrition Considerations

When should Enteral Nutrition be started?	Within 24 hours of admission
Can you feed on pressors?	Yes if careful after resuscitation (enteral nutrition can increase splanchnic blood flow by 60%) (decrease in splanchnic blood flow increases the release of pro-inflammatory mediators) gut ischemia has been found in <1% of enteral fed patients
How long should the patient be NPO after surgery?	Study in Liver transplant patients showed feeding less than 48 hours after surgery (reduced in sepsis)
Should be held for no BS?	No
What decreases gut motility?	If feeding is started less than 24 hours, potassium levels should be greater than 4 mEq/L and Mg >2 mEq/L, do not over hydrate the patient after surgery, BG levels should be less than 200 mg/dl

Enteral Formula

- Consider a hyoposmolar formula with hemodynamically unstable
- Low dextrose formula may be appropriate in the ICU setting
- Consider alternative formulas in ARF, ARDS, inflammation and DM
- Consider trophic feedings in higher risk patients opposed to holding nutrition

TPN

- High nutrition risk patients should start TPN as soon as possible following ICU admission
- Use of protocols and nutrition support teams should be incorporated to reduce the risk of PN
- One should use non-soy based lipids once they become available in US
- In patients that are at low nutrition TPN should be held for 7 days following ICU admission (very low) If unable to meet 60% of needs supplemental TPN is recommended in either low to high nutrition risk but not to start prior to 7-10 day period (moderate)

Case Study

- This is a 72 YOM with a dx of heart failure, non-ischemic cardiomyopathy, non-obstructive CAD, ascites, DM, CKD III, hx of CVA, BVD ICD, a-fib. (3/12/13) heart and kidney transplant. Patient had visible muscle and fat loss prior to transplant.

- Diet History: Dietary intake at home consist of breakfast with friends at a local all you can eat. He often skips lunch as it is not available him because his wife often dose not make him lunch. He eats a variety of foods at his dinner meal including red beans and rice, pinto beans, or chili. Patient reports no previous diet education.

- Weights: (1/9) 56.4 BMI 18.9, 1/13 42.07 (14.1), (2/2) 63.07 BMI 21.4, (2/14) 59.5, (2/28) 48.9 after dialysis, (3/11) 64.2, (3/24) 60.02, (3/27) 58.3 BMI 19.5

- 1/22 The patient was eating 100% of meals and receiving night time feedings for supplementation.

- 1/28 Night time feedings were increased to encourage additional weight gain and provided at night 960 kcals and 88 gms of protein (2.1 gms/kg CBW). The patient continued to eat well at this time. Weight was noted to be 41.9.

Case Study

- 3/12 Patient now s/p heart and kidney transplant.
- 3/14 Feedings changed to night time feedings to encourage po intake of meals
- 3/26 Tube feedings were discontinued and patient was educated on post transplant nutrition including DM diet, food safety, and heart healthy diet.
- 6/5 Asked to see patient in clinic to review diabetic diet as po intake of meals had improved and blood glucose levels have been elevated. Wt. 62.5 kg

Questions

- What vitamin or mineral deficiency is common in the heart failure population
  - A. Vitamin A
  - B. Thiamine
  - C. Zinc
  - D. Vitamin E
- Is sarcopenia obesity a risk factor for post-surgical complication?
  - A. True
  - B. False

Questions?????

References

- Nutrition Support Core Curriculum American Society for Parenteral and Enteral Nutrition Ch 2,3, 4,14,16, and 17
- Perioperative Nutrition Therapy JPEN Martindale et al Sept 2013 vol 37 Supplement 1 p 5-20
- The Surgically Induced Stress Response Finnerty et al JPEN Vol 37 Supplement 1 p 21-29
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