Malnutrition in Hospitalized Patients

- Consequences:
  - Poor wound healing
  - Higher rate of infections
  - Greater length of stay (readmission for elderly)
  - Increased costs
  - Increased morbidity and mortality
  - Suboptimal surgical outcome
Nutrition Assessment

- Collecting, integrating, and analyzing nutrition-related data
  - Including food-drug interactions, cultural, religious and ethnic food preferences, age related nutrition issues and the need for diet counseling
- Dietitian to evaluate patient’s nutritional status and the extent of any malnutrition
- Data gathered will provide the objective basis for recommendations and evaluation of care
- Includes a chart review and patient interview

Purpose of Nutrition Assessment

- Estimates functional status, diet intake and body composition compared to normal populations
- Body composition reflects calorie and protein needs
- Nutritional status predicts hospital morbidity, mortality, length of stay, cost
- Baseline body composition and biochemical markers determine if nutrition support is effective
Nutrition Screening

- Includes height, weight, unintentional weight loss, change in appetite and serum albumin
- Data used to determine patients at nutritional risk and the need for a detailed assessment
- Nutrition care plan developed to reflect calorie, protein and other nutrient needs from the information collected
- Implement plan
- Monitor and revise as needed

Screening: Nutrition Care Indicators

- Nutritional history
  - Appetite
  - Nausea/vomiting (>3 days)
  - Diarrhea
  - Dysphagia
  - Reduced food intake (<50% of normal for 5 days)
- Feeding modality
  - TPN/PPN
  - TF
  - Diet restrictions
- Unintentional Weight Loss
  - >10 lbs in past 3 months
- Serum Albumin
- Diagnosis
  - Cachexia, end-stage liver or kidney disease, coma, malnutrition, decubitis ulcers, cancer of GI tract, Crohns, Cystic Fibrosis, new onset diabetes, eating disorder
- Above used to determine nutritional risk and need for referral to RD
Components of Nutrition Assessment

- Medical and social history
- Diet history and intake
- Clinical examination
- Anthropometrics
- Biochemical data

Medical and Social History

- Gathered from chart review and patient interview
- Medical history: diagnosis, past medical and surgical history, pertinent medications, alcohol and drug use, bowel habits
- Psychosocial data: economic status, occupation, education level, living and cooking arrangements, mental status
- Other: age, sex, level of physical activity, daily living activities
Dietary History and Intake

- Appetite and intake: taste changes, dentition, dysphagia, feeding independence, vitamin/mineral supplements
- Eating patterns: daily and weekend, diet restrictions, ethnicity, eating away from home, fad diets
- Estimation of typical calorie and nutrient intake: RDAs, Food Guide Pyramid
  - Obtain diet intake from 24-hour recall, food frequency questionnaire, food diary, observation of food intake

Diet Assessment

- Evaluate what and how much person is eating, as well as habits, beliefs and social conditions that may put person at risk
- Usual intake
  - 24 hr recall: retrospective, easy
  - Food logs: prospective, requires motivation
  - Food frequency questionnaire: general idea of how often foods are consumed
- Compare to estimation of needs
Nutritional Questions for the Review of Systems

- General
  - Usual adult weight
  - Current weight
  - Maximum, minimum weights
  - Weight change 1 and 5 years prior
  - Recent changes in weight and time period
  - Recent changes in appetite or food tolerance
  - Presence of weakness, fatigue, fever, chills, night sweats
  - Recent changes in sleep habits, daytime sleepiness
  - Edema and/or abnormal swelling

Nutritional Questions for the Review of Systems

- Alimentary
  - Abdominal pain, nausea, vomiting
  - Changes in bowel pattern (normal or baseline)
  - Diarrhea (consistency, frequency, volume, color, presence of cramps, food particles, fat drops)
  - Difficulty swallowing (solids vs. liquids, intermittent vs. continuous)
  - Early satiety
  - Indigestion or heartburn
  - Food intolerance or preferences
  - Mouth sores (ulcers, tooth decay)
  - Pain in swallowing
  - Sore tongue or gums
**Nutritional Questions for the Review of Systems**

- **Neurologic**
  - Confusion or memory loss
  - Difficulty with night vision
  - Gait disturbance
  - Loss of position sense
  - Numbness and/or weakness

- **Skin**
  - Appearance of a diagnostic rash
  - Breaking of nails
  - Dry skin
  - Hair loss, recent change in texture

**Clinical Examination**

- Identifies the physical signs of malnutrition
  - Temporal wasting
  - Signs do not appear unless severe deficiencies exist
  - Most signs/symptoms indicate two or more deficiencies
  - Examples: see list attached
    - Hair: easily plucked, thin; protein or biotin deficiency
    - Mouth: tongue fissuring (niacin), decreased taste/smell (zinc)
Anthropometrics

- Inexpensive, noninvasive, easy to obtain, valuable with other parameters
- Height, weight and weight changes
- Segmental lengths, fat folds and various body circumferences and areas
- Repeated periodically to note changes
- Individuals serve as own standard
- Changes are not obvious for 3-4 weeks

Disadvantages of Anthropometrics

- Intra and interobserver error
- Changes in composition of patient’s tissues
- Inaccurate application of raw data
- Measurements are evaluated by comparing them with predetermined reference limits that allow for classification into risk categories
Anthropometrics

- Height-measured
  - Commonly overestimated in men and underestimated in women
  - Estimates for bedridden or wheelchair bound
    - Arm span, recumbent length
    - Knee-height with calipers
- Weight-measured
  - Effect of fluid status
    - Edema and ascites falsely elevate weight
- Weight history
  - Weight change over time

Anthropometrics

- Ideal body weight
  - Males: 106 lbs + 6 lbs per inch over 5 ft
  - Females: 100 lbs + 5 lbs per inch over 5 ft
  - Add 10% for large-framed and subtract 10% for small-framed
- %IBW = (current wt/IBW) X 100
  - 80-90% mild malnutrition
  - 70-79% moderate malnutrition
  - 60-69% severe malnutrition
  - <60% non-survival
Anthropometrics

- %UBW: usual body weight
  - = (current wt/UBW) X 100
  - 85-95% mild malnutrition
  - 75-84% moderate malnutrition
  - 0-74% severe malnutrition

- % weight change = usual weight – present weight/usual weight X 100

- Significant weight loss
  - >5% in 1 month
  - >10% in 6 months

Body Mass Index = BMI

- Evaluation of body weight independent of height

- BMI = weight (kg)/height^2 (m)
  - >40 obesity III
  - 30-40 obesity II
  - 25-30 overweight
  - 18.5-25 normal
  - 17-18.4 PEM I
  - 16-16.9 PEM II
  - <16 PEM III
Health Risk and Central Obesity

- Upper body obesity = increased risk
- Waist > 35 inches in females
- Waist > 40 inches in males
- Clinically significant for BMI 25-35
- BMI >35 health risk high and not increased further by waist circumference

Frame Size

- Determined using wrist circumference and elbow breadth
- Determines the optimal weight for height to be adjusted to a more accurate estimate
- Wrist circumference: measures the smallest part of the wrist distal to the styloid process of the ulna and radius
- Elbow breadth: measures the distance between the two prominent bones on either side of the elbow
**Skinfold Thickness**

- Estimates subcutaneous fat stores to estimate total body fat
- Compared with percentile standards from multiple body sites or collected over time
- Triceps, biceps, subscapular, and suprailiac using calipers are most commonly used
- Disadvantages: total body fluid overload, caliper calibration, inter-individual variability

**Body Circumferences and Areas**

- Estimates skeletal muscle mass (somatic protein stores and body fat stores)
- Midarm or upper arm circumference (MAC): on the upper arm at the midpoint between the tip of the acromial process of the scapula and the olecranon process of the ulna
- Midarm muscle or arm muscle circumference (MAMC): determined from the MAC and triceps skinfold (TSF)
  \[
  \text{MAMC} = \text{MAC} - (3.14 \times \text{TSF})
  \]
- Total upper arm area: determines upper arm fat stores
- Upper arm muscle mass provides a good indication of lean body mass, used in the calculation of upper arm fat area
- Upper arm fat area: calculation may be a better indicator of changes in fat stores than TSF
Bioelectrical Impedance Analysis (BIA)

- Measures electrical conductivity through water in difference body compartments
- Uses regression equations to determine fat and LBM
- Serial measures can track changes in body composition
  - Obesity treatments

DEXA: dual-energy X-ray absorptiometry

- Whole body scan with 2 x-rays of different intensity
- Computer programs estimate
  - Bone mineral density
  - Lean body mass
  - Fat mass
  - “Best estimate” for body composition of clinically available methods
**Anthropometrics: additional methods**

- Research methods: precise, but cost prohibitive
  - Total body potassium
  - Underwater weight (hydrodensitometry)
  - Deuterated water dilution

- Muscle strength and endurance

**Biochemical Data**

- Used to assess body stores
- Altered by lack of nutrients, medications, metabolic changes during illness or stress
- Interpret results carefully
- Fluid status distorts results
- “Stressed” states (infection, surgery) effects results
- Use reference values established by individual lab
Visceral Proteins

- Produced by the liver
- Affected by protein deficiency, but also renal and hepatic disease, wounds and burns, infections, zinc and energy deficiency, cancer, inflammation, hydration status, and stress

Albumin

- Half life 14-21 days
- Normal value 3.5-5.0 g/DL
- Most widely used indicator of nutritional status
- Acute phase response: levels decrease in response to stress (infection, injury)
- Affected by volume
  - Increases with dehydration, decreases with edema and overhydration
**Prealbumin**

- Better measure of nutritional status due to shorter half-life, ~2 days
- Normal value: 18-40 mg/DL
- Responds within days to nutritional repletion
- Levels affected by trauma, acute infections, liver and kidney disease; highly sensitive to minor stress and inflammation

**C-reactive protein**

- Positive acute phase respondent
- Increases early in acute stress as much as 1000-fold
- Decreased correlates with end of acute phase and beginning of anabolic phase where nutritional repletion is possible
Creatinine Height Index

- Estimates LBM
- \[ = \text{actual creat excretion (24 hour urine collection)} \]
  \[ \frac{\text{expected creat excretion}}{} \]
- Males: IBW X 23 mg/kg
- Females: IBW X 18 mg/kg
- >80% normal
- 60-80% moderately depleted
- <60% severely depleted
- Accurate 24-hr urine collection is difficult to obtain in acute-care setting

Hematological Indices

- Determine nutritional anemias
- Transferrin: Fe transport protein
- TIBC: total Fe binding capacity
  - Indicates number of free binding cites on transferrin
- Fe deficiency: increased transferrin levels, decreased saturation
- Ferritin: Fe storage protein, increases during inflammation
- Depressed hemoglobin is an indicator of Fe deficiency anemia
Nitrogen balance

- Goal for repletion is a positive nitrogen balance
- 24-hr record of protein intake and urine collection is required
- Done within 48 hr after initiation of nutrition therapy
- Results not valid in conditions with high protein losses (burns or high-output fistulas)
- \[ N \text{ balance} = \frac{\text{protein intake}}{6.25} - \left( \text{urinary urea N + 3 or 4} \right) \]

Estimation of Nutrient Needs

- Predictive equation for energy (calorie) needs
- Harris Benedict uses age, height, and weight to estimate basal energy expenditure (BEE), the minimum amount of energy needed by the body at rest in fasting state
- In men:
  \[ \text{BEE (kcal/day)} = 66.5 + (13.8 \times W) + (5.0 \times H) - (6.8 \times A) \]
- In women:
  \[ \text{BEE (kcal/day)} = 655.1 + (9.6 \times W) + (1.8 \times H) - (4.7 \times A) \]
- Where \( W \) = weight in kilograms, \( H \) = height in centimeters and \( A \) = age in years
- BEE is multiplied by an activity factor and injury factor to predict total daily energy expenditure
Activity Categories

- Confined to bed = 1.0-1.2
- Out of bed = 1.3
- Very light = 1.3
- Light = 1.5 (women), 1.6 (men)
- Moderate = 1.6 (women), 1.7 (men)
- Heavy = 1.9 (women), 2.1 (men)

Injury Categories

- Surgery
  - Minor = 1.0-1.1
  - Major = 1.1-1.2

- Infection
  - Mild = 1.0-1.2
  - Moderate = 1.2-1.4
  - Severe = 1.4-1.8

- Trauma
  - Skeletal = 1.2-1.35
  - Blunt = 1.15-1.35
  - Head trauma treated with steroids = 1.6

- Burns
  - Up to 20% body surface area (BSA) = 1.0-1.5
  - 20-40% BSA = 1.5-1.85
  - Over 40% BSA = 1.85-1.95
**Energy Needs**

- Quick rule of thumb
- Also calculated based on weight in kilograms and adjusted for activity level
  - 25-30 kcal/kg for acute illness, minimally active, overweight, >80
  - Adjusted body weight
  - 30-35 kcal/kg for young, active

**Indirect calorimetry/Metabolic Cart**

- Measures CO₂ produced and O₂ consumed in critically ill patients on ventilators
- Calculates resting metabolic rate based on gas exchange
- Respiratory quotient calculated
  - Corresponds to oxidation of nutrients
  - CHO: 1:1 ratio of CO₂ produced/O₂ consumed
  - Lipid: 0.7:1 ratio
  - Protein: 0.82:1 ratio
  - Mixed diet: 0.85:1 ratio
  - Overfeeding/lipogenesis: >1.0
**Protein Needs**

- Determined based on clinical condition and body weight in kilograms
- Normal - RDA: 0.8 g/kg for adult
- Fever, fracture, infection, wound healing: 1.5-2.0
- Protein repletion: 1.5-2.0
- Burns: 1.5-3.0
- Typically use range of 1.1-1.4 g/kg
- Decreased protein needs in acute renal failure
- Comparison of intake to needs will indicate intervention required

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**Subjective Global Assessment**

- Alternative method to assess nutritional status of hospitalized patients
- Combines information from the patient’s history with parts of a clinical exam
Subjective Global Assessment

- History
  - Unintentional weight loss over the past 6 months
  - Pattern and amount of weight loss is considered
  - Weight change in past 2 weeks
  - Weight of <5% is small, loss >10% is significant
  - Dietary intake change (relative to normal)
  - GI symptoms >2 weeks (nausea, vomiting, diarrhea, anorexia)
  - Functional capacity (energy level: daily activities, bedridden)
  - Metabolic demands of primary condition noted

- Physical Exam
  - Each feature is noted as normal, mild, moderate, or severe based on clinician’s subjective impression
  - Loss of subcutaneous fat measures in the triceps and the mid-axillary line at the lower ribs
  - Muscle wasting in the quadriceps and deltoid area
  - Presence of edema in ankle or sacral region
  - Presence of ascites
SGA Rating

- Determined by subjective weighting
- May choose to place more emphasis on weight loss, poor dietary intake, subcutaneous tissue loss, muscle wasting
- Must be trained in this technique to achieve consistency
- Scoring may predict development of infection more accurately than other objective measures of nutritional status (albumin)
  - A = well nourished (60% reduction in post-op complications)
  - B = moderately malnourished (at least 5% wt loss with decreased intake and subcutaneous loss)
  - C = severely malnourished (4X more post op complications, 10% wt loss and physical signs of malnutrition)
- Ascites and edema decrease significance of body weight

Subjective Global Assessment

- Advantages
  - Predicts post-surgical complications
  - Does not require lab testing
  - Can be taught to a broad range of health professionals
  - Compares favorably with objective measurements
  - Validated in liver transplant, dialysis, and HIV patients
- Disadvantages
  - Subjective and dependent on the experience of the observer
  - Not sensitive enough to use in following nutrition progress
Nutrition Screening Initiative

- From 1991, is a checklist for the elderly to use in early identification of common nutrition problems
- 9 warning signs of poor nutritional status
  - Disease, poor eating pattern, tooth loss/mouth pain, economic hardship, reduced social contact, multiple medications, involuntary weight loss/gain, a need for assistance in self care, and older than 80
- When concerns are identified, interventions are suggested
- Goal is to provide appropriate intervention before health and quality of life are seriously impaired