Nutritional Assessment in Chronic Diseases

Adam Raman
Western University

and

Justine Turner
University of Alberta
Name: Dr. Adam Rahman

**Conflict of Interest Disclosure**

(over the past 24 months)

<table>
<thead>
<tr>
<th>Commercial or Non-Profit Interest</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shire</td>
<td>Advisory board, Speaker, Consultant</td>
</tr>
<tr>
<td>Fresenbius Kabi</td>
<td>Speaker, consultant</td>
</tr>
<tr>
<td>Baxter</td>
<td>Speaker, research support</td>
</tr>
<tr>
<td>ASPEN</td>
<td>Research award</td>
</tr>
<tr>
<td>Canadian Fragility Network</td>
<td>Research award</td>
</tr>
</tbody>
</table>
### Conflict of Interest Disclosure
(over the past 24 months)

<table>
<thead>
<tr>
<th>Commercial or Non-Profit Interest</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASPEN</td>
<td>Research Committee member</td>
</tr>
<tr>
<td>NASPGHAN</td>
<td>Chair Nutrition Committee</td>
</tr>
<tr>
<td>GlyPharma</td>
<td>Research support</td>
</tr>
</tbody>
</table>

Name: Dr. Justine Turner
Objectives

• Understand how to conduct a nutrition focused examination across all ages

• Understand the role of laboratory tests

• Understand the emerging role of new technologies to assess sarcopenia
DOES MALNUTRITION MATTER?
Does Malnutrition Matter?

- 2010 Health care cost and utilization project (HCUP)
  - 80,710 patients ≤17 years coded diagnosis of malnutrition during hospitalization (1.3% total)

Adult Malnutrition

Malnutrition in adults:

1) Undernourishment resulting from insufficient food intake

2) Overnutrition caused by excess food intake; imbalance due to disproportionate food intake

3) Specific nutrient deficiencies

Burden of malnutrition:

Caused by chronic Protein-Energy imbalance

accentuated by

Cachexia (disease related loss of muscle, weakness and lethargy)

and

Sarcopenia (specific loss of muscle related to ageing)

Jeejeebhoy CMTF presentation 2013
http://rgps.on.ca/files/Dr%20Jeejeebhoy%20CMTF%202013KNJ.pdf
Pediatric Malnutrition

Acute
- < 3 months
- Low Wt for Length
  - Z Score: < -3 SD (WHO)
- Visible wasting
  - Wt for Age: Z Score: < -2 SD
  - MUAC: < 115 mm
- Nutritional Edema

Chronic
- > 3 months
- Stunting
  - Length/Ht for age: Z Score: < -2 SD

Case History

- 19 year old female, with newly diagnosed ileocolonic CD admitted with Crohn’s flare (pain, weight loss, nausea, vomiting)

- Marked anorexia prior to admission

- CT scan revealed significant ileo-colonic stricture

- Her Imuran was held and she was started on IV steroids
STARTING AT THE BEDSIDE
WHAT DO YOU DO?
Starting at the Bedside

• Medical and Social history
• Dietary history
• Physical examination
  – clinical signs and symptoms of malnutrition
• Biochemical data
• Anthropometry and Body composition
Starting at the Bedside

- **Medical and Social history**
- **Dietary history**
- Physical examination
  - clinical signs of malnutrition
- Biochemical data
- Anthropometric and body composition

Physical signs do not usually appear until moderate or severe malnutrition and are non-specific
The Case

- Marked anorexia for 3 months due to nausea and abdominal pain
- Restrictive diet
- 22 lb weight loss over 4 months
- Muscle atrophy
- No peripheral edema
Laboratory

- HgB 108, MCV 82.1, Ferritin 17.6, PLT 421
- CRP 4.6
- Na 137, K 3.2, Cl 101, Cr 86
- Albumin 28, Prealbumin 0.16, Transferrin 16.3
- 25-OH Vitamin D 42, Vitamin B12, Vitamin A 124, Vitamin C 6, Vitamin E 35, Selenium 1.8, Zinc 201
BMI

BMI - Pros
• Easy to use
• Correlates with body fat measures
• To some degree independent of height
• High correlation with specific diseases
• Permits comparison between groups

BMI - Cons
• Not as useful
• Children, elderly, athletes, pregnancy
• Not a measure of body composition
• Influenced by hydration status
• Does not assess fat distribution
Clinical Judgement

- Length and height must be measured accurately for accurate BMI
- Edema will ‘elevate’ weight
- Stunting over time will ‘improve’ BMI
- Short stature leads to underestimation of malnutrition
- Z scores do not replace clinical examination findings
  - Is there wasting or not?
Subjective Global Assessment

- Valid tool that correlates with outcomes
- Detailed questionnaire, tests and exam
  - Anthropometrics
  - Dietary intake
  - GI Symptoms
  - Functional status
  - Metabolic stress
  - Muscle wasting, fat loss and edema

Secker & Jeejeebhoy *Am J Clin Nutr.* 2007;85:1083-1089
# SGNA History

## Medical History

### Weight Change

<table>
<thead>
<tr>
<th>Weight</th>
<th>__________ kg</th>
<th>Height</th>
<th>__________ cm</th>
</tr>
</thead>
</table>

- Weight loss over the past 6 months:  
  - No [ ]  
  - Yes [ ]

- Weight loss (if known):  
  - __________ kg  
  - __________ %

- Weight change over the past 2 weeks:  
  - Gain [ ]  
  - No loss [ ]  
  - Continued Loss [ ]

- Weight change (if known):  
  - __________ kg  
  - __________ %

## Diet Change

- Normal intake [ ]  
- Reduced intake [ ]  
- Semisolid or liquid diet [ ]  
- Very poor intake or starvation [ ]

## Gastrointestinal Symptoms (persisting for > 2 weeks)

- **Pain on eating**:  
  - No [ ]  
  - Yes [ ]  
  - Severe [ ]

- **Nausea**:  
  - No [ ]  
  - Yes [ ]  
  - Severe [ ]

- **Vomiting**:  
  - No [ ]  
  - Yes [ ]  
  - Severe [ ]

- **Diarrhea**:  
  - No [ ]  
  - Yes [ ]  
  - Severe [ ]

## Functional Capacity

- Normal [ ]  
- Reduced capacity [ ]  
- Unable to work [ ]

- Ambulatory [ ]  
- Bed ridden [ ]

---

Copyright 2011 JeejJeebhoy Holdings Inc
### SGNA History

- Growth
- Weight loss
- Diet intake
- GI Symptoms
- Functioning
- Disease

**Secker & JeejJeebhoy**

*J Am Acad Diet. 2012;112:424-431*
# PSGNA Exam & Scoring

<table>
<thead>
<tr>
<th>PHYSICAL EXAM</th>
<th>SGNA SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
</tr>
<tr>
<td>Loss of subcutaneous fat</td>
<td></td>
</tr>
<tr>
<td>□ no loss in most or all areas</td>
<td></td>
</tr>
<tr>
<td>□ loss in some but not all areas</td>
<td></td>
</tr>
<tr>
<td>□ severe loss in most or all areas</td>
<td></td>
</tr>
<tr>
<td>Muscle Wasting</td>
<td></td>
</tr>
<tr>
<td>□ no wasting in most or all areas</td>
<td></td>
</tr>
<tr>
<td>□ wasting in some but not all areas</td>
<td></td>
</tr>
<tr>
<td>□ severe wasting in most or all areas</td>
<td></td>
</tr>
<tr>
<td>Edema (nutrition-related)</td>
<td></td>
</tr>
<tr>
<td>□ no edema</td>
<td></td>
</tr>
<tr>
<td>□ moderate</td>
<td></td>
</tr>
<tr>
<td>□ severe</td>
<td></td>
</tr>
</tbody>
</table>

## Guidelines for Aggregating Items into Global Score

In assigning an overall global score, consider all items in the context of each other. Give the most consideration to changes in weight gain and growth, intake, and physical signs of loss of fat or muscle mass. Use the other items to support or strengthen these ratings. Take recent changes in context with the patient’s usual/chronic status. Was the patient starting off in a normal or nutritionally-compromised state?

**Normal/Well nourished**
This patient is growing and gaining weight normally, has a grossly adequate intake without gastrointestinal symptoms, shows no or few physical signs of wasting, and exhibits normal functional capacity. Normal ratings in most or all categories, or significant, sustained improvement from a questionable or moderately malnourished state. It is possible to rate a patient as well nourished in spite of some reductions in muscle mass, fat stores, weight and intake. This is based on recent improvement in signs that are mild and inconsistent.

**Moderately malnourished**
This patient has definite signs of a decrease in weight and/or growth, and intake and may or may not have signs of diminished fat stores, muscle mass and functional capacity. This patient is experiencing a downward trend, but started with normal nutritional status. Moderate ratings in most or all categories, with the potential to progress to a severely malnourished state.

**Severely malnourished**
This patient has progressive malnutrition with a downward trend in most or all categories. There are significant physical signs of malnutrition—loss of fat stores, muscle wasting, weight loss >10%—as well as decreased intake, excessive gastrointestinal losses and/or acute metabolic stress, and definite loss of functional capacity. Severe ratings in most or all categories with little or no sign of improvement.
Body circumferences

NHANES I and II References adults:
Risk for malnutrition: 5th-15th percentile
Adult MUAC < 23.5cm, BMI likely < 20kg/m2

WHO References children 0-6 years old:
Mild < -1 to severe ≤ -3 z score SD
Skin fold thicknesses
Bed side tests of function
WHAT DO YOU ORDER?
OR NOT
The Case

- Responded to IV steroids
- Transitioned to Remicade
- Nutritional plan:
Serum Proteins

- Poorly representative of protein status
- Low sensitivity, low specificity
- Affected by many factors
  - protein intake, protein metabolism/synthesis
  - hydration, medications, medical condition, liver disease, activity level, pregnancy
Serum Proteins

- Poorly representative of protein status
- Low sensitivity, low specificity
- Affected by many factors

<table>
<thead>
<tr>
<th></th>
<th>Half life</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Albumin</strong></td>
<td>20 days</td>
<td>Infections, SIRS, fluid overload, liver and kidney disease (all ↓)</td>
</tr>
<tr>
<td><strong>Prealbumin</strong></td>
<td>2-3 days</td>
<td>Infections, liver (↓); kidney disease (↑)</td>
</tr>
<tr>
<td><strong>IGF1</strong></td>
<td>&lt; 12 hours</td>
<td>Infections, SIRS, liver disease</td>
</tr>
</tbody>
</table>

Currently NOT recommended
Micronutrients

• Nearly all vitamins and minerals can be measured in serum
• May ↑ or ↓ with certain diseases
  – may or may not be valid to measure
  – more often a 'screen' with limitations
• ? If serum levels reflect body stores
  – often the best measure we have
<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Limitations and Testing</th>
</tr>
</thead>
</table>
| Zinc     | 90% bound to albumin: ↓ in acute phase reaction (APR) can measure zinc-dependent T cell immune function to detect mild deficiency with normal plasma level.<br>
consider empiric trial growth failure |
| Selenium | selenoproteins (glutathione peroxidase, selenoprotein P: ↓ APR consider RBC glutathione peroxidase; hair and nails |
| Copper   | stored in liver, 90% bound to ceruloplasmin: ↑ APR can measure functional metalloenzymes eg. diamine oxidase<br>
consider intake reduction cholestatic liver disease |
| B vitamins | most are better measured in RBC (eg. folate) or as functional enzyme (eg. pyridoxial 5-phosphate for B6; plasma MMA↑ for B12 with a high rate of false low values) |
| Vitamin E | circulates in serum lipoprotein so will be low if serum lipids use the adjusted vitE:cholesterol ratio |
Anemia

• RBC synthesis requires $B_{12}$, folate, iron
• All three nutrients should be checked
• Need to examine the Complete Blood Cell Count (CBC) to differentiate between anemia of chronic diseases vs dietary intake or both (MCV;RDW)
• ↓ $B_{12}$ and folate:
  – chronic disorders (liver disease, kidney disease, alcoholism)
  – malabsorption diseases (celiac, IBD)
Which Macronutrients are Deficient?
Assessment of Micronutrient Status

- Hair
- Eyes
- Nails
- Mouth
- Skin
New Technology
Sarcopenia

• Progressive and generalized loss of skeletal muscle mass and function (strength)

• Disease of aging OR aging by disease

• Correlated with physical disability, poor quality of life and risk of death
Frailty Phenotype

- Exhaustion
- Slow Gait
- Weight loss
- Low physical activity

Sarcopenia

- Muscle Weakness
- ↓ Muscle Mass

↓ Cognitive/neuro function

Vulnerability

Frailty
DEXA

Whole body scanning time: 5-10 minutes

Effective radiation dose: 0.03μSv
Body Plethysmography
Using CT Images for Body Comp

• Diagnostic CT images at standard landmark: 3rd lumbar vertebrae (L3)
• Image analysis: Slice-O-matic software
• Cross-sectional areas (cm²) of muscle, intermuscular, visceral and subcutaneous adipose tissue determined
Normal vs Patient
Evaluation and Certificate of Attendance

Please download the CDDW™ app to complete the session evaluation and to receive your certificate of attendance.

CDDW™ has gone mobile!

Get the CDDW app on your mobile device now, for free.

1. Download the Guidebook app.
2. Search for “CDDW 2017”.
3. Start planning your CDDW experience.