Protein Energy Malnutrition

Omar Saadah MBBS,MRCP,CABP,DCH
Assistant Professor of Pediatrics
Pediatric Gastroenterology, Hepatology & Clinical Nutrition

Faculty of Medicine, King Abdulaziz University
Protein Energy malnutrition (anthropometric measurements)

- **Underweight**
  - Measurements that fall below 2 standard deviations under the normal weight for age.

- **Stunting**
  - Measurements that fall below 2 standard deviations below height for age.

- **Wasting**
  - Measurements that fall below 2 standard deviations below weight for height.
Protein Energy malnutrition
(Clinical diagnosis)

Weight for height below 70% of the median

Bipedal edema

Visible severe wasting
Micronutrient deficiencies

- Iron: fatigue, anemia, decreased cognitive function, glossitis and nail changes
- Iodine: Goiter, developmental delay, and MR
- Vitamin D: poor growth, rickets, and hypocalcemia
- Vitamin A: night blindness, xerophthalmia, poor growth, and hair changes
- Folate: Glossitis, anemia
Clinical forms of PEM

- **Marasmus:**
  - Severe wasting
- **Marasmic kwashiorkor**
  - Severe wasting in the presence of edema
- **Kwashiorkor**
  - Malnutrition with edema
**Gomez Classification of Malnutrition**

% of reference weight for age = \( \frac{\text{(patient weight)}}{\text{(weight of normal child of same age)}} \) * 100

<table>
<thead>
<tr>
<th>Percentage of reference weight for age</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-110%</td>
<td>normal</td>
</tr>
<tr>
<td>75-89%</td>
<td>Grade I: mild malnutrition</td>
</tr>
<tr>
<td>60-74%</td>
<td>Grade II: mod malnutrition</td>
</tr>
<tr>
<td>&lt; 60%</td>
<td>Grade III: severe malnutrition</td>
</tr>
</tbody>
</table>
## Wellcome Classification of Malnutrition

<table>
<thead>
<tr>
<th>Weight for age (Gomez)</th>
<th>With Edema</th>
<th>Without Edema</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-80%</td>
<td>Kwashiorkor</td>
<td>Undernutrition</td>
</tr>
<tr>
<td>&lt; 60%</td>
<td>Marasmic-Kwashiorkor</td>
<td>Marasmus</td>
</tr>
</tbody>
</table>
Waterlow Classification of malnutrition

% Weight for height = \( \frac{\text{weight of patient}}{\text{weight of a normal child of the same height}} \) * 100

% Height for age = \( \frac{\text{height of patient}}{\text{height of a normal child of the same age}} \) * 100

<table>
<thead>
<tr>
<th>Weight for Height (wasting)</th>
<th>Height for age (stunting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&gt;90</td>
</tr>
<tr>
<td>Mild</td>
<td>80-90</td>
</tr>
<tr>
<td>Moderate</td>
<td>70-80</td>
</tr>
<tr>
<td>Severe</td>
<td>&lt;70</td>
</tr>
</tbody>
</table>
# Severity of undernutrition

<table>
<thead>
<tr>
<th>Grade of Malnutrition</th>
<th>Criteria of Waterlow</th>
<th>Criteria of Gomez et al</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median Weight for Height (%)</td>
<td>Median Height for Age (%)</td>
</tr>
<tr>
<td>Normal</td>
<td>90-110</td>
<td>&gt;95</td>
</tr>
<tr>
<td>Mild</td>
<td>80-89</td>
<td>90-94</td>
</tr>
<tr>
<td>Moderate</td>
<td>70-79</td>
<td>85-89</td>
</tr>
<tr>
<td>Severe</td>
<td>&lt;70</td>
<td>&lt;85</td>
</tr>
</tbody>
</table>
Example

- A 5 year old boy who has been ill for the last 6 weeks. Appeared miserable with wasting but no edema. His weight=10 kg, height=106 cm.

Calculations:

\[
\text{\% Wt for Ht} = \left( \frac{\text{Patient weight}}{\text{Weight of normal child with the same height}} \right) \times 100
\]

\[
\frac{10}{18} \times 100 = 55\%
\]

Conclusion: severe malnutrition (marasmus)
Prevalence of protein-energy malnutrition among children under 5 years of age in developing countries, 1995

<table>
<thead>
<tr>
<th>Region</th>
<th>Stunting %</th>
<th>underweight %</th>
<th>wasting %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>39</td>
<td>28</td>
<td>8</td>
</tr>
<tr>
<td>Asia</td>
<td>41</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td>Latin America</td>
<td>18</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Oceania</td>
<td>31</td>
<td>23</td>
<td>5</td>
</tr>
</tbody>
</table>
Protein-energy malnutrition
Epidemiology

Causes of PEM

- Early weaning
- Delayed introduction of complementary food
- Low protein diet
- Severe or frequent infections.

Usually manifest between 6 months and 2 years of age
Direct and indirect causes of malnutrition

Malnutrition
- Marasmus, kwashiorkor
- Micronutrient deficiency

Insufficient supply
- Of protein, energy
- Or micronutrients

Insufficient
- Child and Maternal care

Severe or
- Frequent infections
diarrhea

Ill health
- Unhealthy environment

Low status and
- Little education
- Of women

War
- Natural disaster

Civil disorder

Poverty
Nutritional assessment

- Medical and dietary history
- Anthropometric evaluation and physical examination
- Laboratory measurements
Medical and dietary history

• **Medical history**
  – review of acute and chronic illnesses
  – history of preexisting nutrient deficiencies
  – social history (poverty, domestic violence, parental employment, parental marital status, and parental substance abuse)

• **Dietary history**
  – quantity and quality of current intake
  – in infants
    • history of breast feeding pattern
    • formula preparation
    • volume consumed
    • feeding techniques
Marasmus: Typical Findings

History

- decreased caloric intake over months to years

Physical examination

- impression: cachectic, severely ill, “little old man” irritable, apathetic, hungry
- underweight, growth retardation
- hair sparse, brittle, easily pulled out
- Corneal opacity
– Poor skin turgor
– nails fragile, thin and fissured
– loss of subcutaneous tissue
– muscle wasting
– abdominal distension (muscular hypotonia)
– Rectal prolapse (loss of perianal fat)
– vital signs: hypothermia, hypotension, bradycardia

Anthropometry:
wasting or stunting, weight for height or height for age is less than 65% of the mean average
Kwashiorkor: Typical Findings

History
– decreased calorie intake over weeks to months

Physical Examination
– may look well nourished, even “fat”, apathetic, irritable, anorexic
– moon facies, pitting edema
– overall fatness
– thin upper arm
– flaking paint rash, pellagrous lesions, fissures, ulcerations
– mucosal thinnes, mild anemia
– lifeless, thin, pale, weak, or dry hair
– fragile and thin nails
– Hepatomegaly (steatosis)
– Vital signs: hypothermia, hypotension

• Anthropometry
  – usually underweight; occasional fat appearance
Laboratory measurements

- Albumin
- Prealbumin
- Transferrin
- Total lymphocyte count (<1500)
- Delayed hypersensitivity
- Hemoglobin
Management
Assessment of severe malnourished child

- Dehydration
- Infection
- Intake of food & drinks & degree of anorexia
- Blood glucose
- Hemoglobin or hematocrit
- Urine examination
- Stool examination for giardia
- CXR & PPD if TB is suspected.
## General principle of treatment

<table>
<thead>
<tr>
<th>Acute or stabilisation phase</th>
<th>Rehabilitation phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>week 2-6</td>
</tr>
<tr>
<td>Day 1-2</td>
<td>Day 3-7</td>
</tr>
</tbody>
</table>

### Look for & treat
- Hypoglycemia
- Hypothermia
- Dehydration
- Infection

### Specific treatment for all children
- Electrolytes
- Micronutrients
- Sensory stimulation
- Initial feeding
- Feeding to achieve catch-up growth
Stabilization or Acute Phase

- Correction of shock & dehydration
  - i.v if shocked
  - ORS (low osmolarity with extra potassium)
- Life threatening complications:
  - Hypoglycemia (<54 mg/dl)
  - Hypothermia (<350 c). Keep the child well clothed, with the head covered, in a warm environment
  - Two hourly feeding (day & night)
- Treatment of infections
- Electrolytes imbalance: ↓K⁺, ↓mg⁺⁺
Stabilization or Acute Phase

- Micronutrient deficiencies
  - Vit A & Zinc (impair immune function & have direct effect on the structure & function of the mucosa.
  - Iron
  - Folic acid
  - Copper (neutropenia, bone abnormalities, microcytic anemia)
  - Selenium (impaired cardiac function)

- Dietary treatment
  - Feeding should be started as soon as possible
  - Diet should have low osmolarity and low lactose
  - The child should be fed every two hours or every three hours
Rehabilitation phase

- The return of appetite heralds the rehabilitation phase and usually occurs a week after treatment is started.
- The goal is to achieve weight gain $>10\text{g/kg/day}$ until the patient is fully recovered.
- Increase in energy & protein intake should be gradual to avoid cardiac failure.
- A child is considered to have recovered on reaching a weight for height that is 90% of the Median.
THANK YOU

Dr Omar Saadah