Practical challenges in Nutritional Support of Pre & Post Liver Transplant

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Prevalence of Malnutrition

- 20% - Compensated liver disease
- >80% - Decompensated liver disease
- 100% - Await Liver Transplant

Antonio J. Sanchez; Mayo Clinic Foundation, 2006
Malnutrition in CLD - Cause

- Anorexia (inadequate oral intake)
- Maldigestion or malabsorption
- Early satiety or dysgeusia
- Restricted diets
- Nausea and vomiting
- Altered metabolism

Abnormalities of metabolism

Poor nutrient intake

MALNUTRITION

Morbidity

Mortality
<table>
<thead>
<tr>
<th>Causes</th>
<th>Etiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced nutrient intake</td>
<td>Decreased Intake and anorexia</td>
</tr>
<tr>
<td></td>
<td>• Unpalatable Diets (Na &amp; H₂O restriction)</td>
</tr>
<tr>
<td></td>
<td>• Disgeusia due to micronutrient deficiencies (Zn or Mg)</td>
</tr>
<tr>
<td></td>
<td>• Anorexia effect caused by increased levels of proinflammatory cytokines and leptin</td>
</tr>
</tbody>
</table>
## Malnutrition in CLD – Cause, Etiology

<table>
<thead>
<tr>
<th>Causes</th>
<th>Etiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced nutrient intake</td>
<td>• Nausea &amp; early satiety</td>
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<tr>
<td></td>
<td>• Starvation</td>
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<tr>
<td></td>
<td>• Hospitalization, Invasive diagnostic procedure requiring fasting, Gastrointestinal bleeding and endoscopic therapies</td>
</tr>
<tr>
<td>Reduced Intestinal absorption</td>
<td>• Maldigestion, Bacterial over growth, Diarrhea</td>
</tr>
<tr>
<td></td>
<td>• Pancreatic insufficiency in Alcohol abuse and/or Cholestasis</td>
</tr>
<tr>
<td></td>
<td>• Drugs (i.e., nonabsorbable disaccharides, antibiotics and cholestyramine)</td>
</tr>
</tbody>
</table>
# Malnutrition in CLD – Cause, Etiology

<table>
<thead>
<tr>
<th>Causes</th>
<th>Etiology</th>
</tr>
</thead>
</table>
| Altered Metabolism/Expenditure | • Protein Catabolism
  • Increased energy expenditure
  • Insulin resistance
  • Increase fat turnover       |
|                               | • Reduced hepatic protein synthesis and increased protein breakdown
  • During ascites and bacterial infections
  • Hepatocellular carcinoma
  • Hyperinsulinemia and reduced nonoxidative glucose metabolism
  • Increased lipolysis due to more rapid transition to starvation
  • Fats are utilized as alternative energy source |
Altered metabolism

<table>
<thead>
<tr>
<th>CHO</th>
<th>Increased</th>
<th>Decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Catabolic hormones (as not degraded by liver)</td>
<td>✓ Post prandial glucose storage</td>
</tr>
<tr>
<td></td>
<td>✓ Gluconeogenesis</td>
<td>✓ Glycogen stores (accelerated starvation)</td>
</tr>
</tbody>
</table>

### Accelerated Starvation

- Fat – major substrate for energy
- 72hrs of Starvation (Normal adult) Vs Overnight fast (Cirrhotic pt)
- Fat & Muscle Breakdown
- Increases Gluconeogenesis ➔ Muscle Wasting
## Altered metabolism

| Protein | • Imbalance in BCAA and aromatic amino acids  
✓ Expected Ratio – 3.5:1  
✓ Decreased to 1:1  
  - increased cerebral uptake of aromatic amino acids  
  - promoting the synthesis of false neurotransmitters  
• Muscle wasting |
|---|---|
| Fat (preferred fuel) | • Nocturnal fat metabolism - impaired synthesis PUFA from EFA  
• Decreased PUFA associated with severity of malnutrition |
Malnutrition in CLD - Pathophysiology

NUTRITION ASSESSMENT
- Serial monitoring of body weight and anthropometry
- Dietary intake
- Subjective global assessment

POSSIBLE CLINICAL FINDINGS
- Abnormal liver function tests
- Jaundice
- Ascites and edema
- Hepatic encephalopathy
- Portal hypertension and varices
- Altered amino acid levels
- Vitamin/mineral deficits
- Glucose intolerance or fasting hypoglycemia

Nutrition Assessment

Subjective Global Assessment (SGA)

- Weight change
- GI symptoms (nausea, vomiting, diarrhea, constipation)
- Co-morbidities
- Muscle Wasting & Fat stores
- Dietary Intake
- Physical Activities

cont...
### Subjective Global Assessment (Adults)

#### (A) Patient’s related medical history

1. **Weight change (overall change in past 6 months)**
   - 1: No weight change or gain
   - 2: Minor weight loss ≤5%
   - 3: Weight loss 5-10%
   - 4: Weight loss 10-15%
   - 5: Weight loss >15%

2. **Dietary Intake (Duration)**
   - 1: No Change
   - 2: Sub-optimal solid diet
   - 3: Full liquid diet or moderate overall decrease
   - 4: Hypo-Caloric liquid
   - 5: Starvation

3. **Gastrointestinal Symptoms (Duration)**
   - 1: No symptoms
   - 2: Nausea
   - 3: Vomiting or moderate GI symptoms
   - 4: Diarrhoea
   - 5: Severe anorexia

4. **Functional Capacity (Nutrition related functional impairment)**
   - 1: None/improved
   - 2: Difficulty with ambulation
   - 3: Difficulty with normal activity
   - 4: Light activity
   - 5: Bed/chair-ridden with no or little activity

5. **Co-morbidity (Disease and its relationship to nutritional requirements)**
   - 1: Healthy
   - 2: Mild co-morbidity
   - 3: Moderate co-morbidity or age > 75 years
   - 4: Severe co-morbidity
   - 5: Very severe co-morbidity

#### (B) Physical Examination

1. **Decreased fat stores or loss of subcutaneous fat**
   - 1: Normal (no change)
   - 2: Moderate
   - 3: Severe

2. **Signs of muscle wasting**
   - 1: Normal (no change)
   - 2: Moderate
   - 3: Severe

**Total Score = Sum of above 7 components**

**Nutritional Status:** Based on this score patient is:
- □ Well nourished: 7-14
- □ Moderately malnourished: 15-28
- □ Severely malnourished: 29-35

Height: ___________ cms
Current weight ___________ kg.

Dietitian .................................................. Date ..................................
Guidelines for estimating fluid weight (kg)

<table>
<thead>
<tr>
<th>Category</th>
<th>Ascites</th>
<th>Odema</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal</td>
<td>2.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>6.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Severe</td>
<td>14.0</td>
<td>10.0</td>
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</tbody>
</table>

- Grade 1 (mild). Ascites is only detectable by ultrasound examination.
- Grade 2 (moderate). Ascites causing moderate symmetrical distension of the abdomen.
- Grade 3 (large). Ascites causing marked abdominal distension.
Fluid retention in ESLD & relevance to nutrition

- Impairs food intake
- Energy expenditure increases
- Negative nitrogen balance
<table>
<thead>
<tr>
<th>Factors influencing the accuracy of common indices used for nutritional assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body weight</strong></td>
</tr>
<tr>
<td>• Water restriction and fluid accumulation</td>
</tr>
<tr>
<td>• Changes in body composition</td>
</tr>
<tr>
<td><strong>Visceral proteins</strong></td>
</tr>
<tr>
<td>• Decreased liver synthesis</td>
</tr>
<tr>
<td>• Increased volume of distribution</td>
</tr>
<tr>
<td><strong>Anthropometry</strong></td>
</tr>
<tr>
<td>• Fluid retention</td>
</tr>
<tr>
<td><strong>Immunological status</strong></td>
</tr>
<tr>
<td>• Hypersplenism</td>
</tr>
<tr>
<td>• Abnormal immunological reactivity</td>
</tr>
<tr>
<td><strong>Creatinine excretion</strong></td>
</tr>
<tr>
<td>• Renal insufficiency</td>
</tr>
<tr>
<td><strong>Bioelectrical impedance analysis</strong></td>
</tr>
<tr>
<td>• Presence of ascites</td>
</tr>
</tbody>
</table>
Nutritional Goals

- Correct malnutrition
- Prevent metabolic complications
- Improve quality of life
- Reduce Perioperative complications
- Nutrition education – Individual care plan
Nutritional Management - CLD

- Energy: 35 to 40 kcal/kg dry weight
  BEE x 1.2 to 1.3, depending on degree of malnutrition
- CHO: 60 – 70 % of cals as complex & simple CHO

- Protein: 1.2 to 1.5 g/kg dry wt depending on degree of malnutrition, malabsorption, metabolic stress
  - To maintain
    - Muscle mass
    - Protein levels in the blood

Nutritional Management - CLD

- Hepatic Encephalopathy
  - BCAA formula
- Fat: 25% to 40% of kcal
- Electrolytes: restrict sodium with edema or ascites (2 - 4 g/day)
- Fluid: restrict fluid if hyponatremia is present
- Individualized
Practical Difficulties in meeting Nutrition Prescription

Study Design : Single Center, Prospective study

Study Duration : May to August 2013

Setting : Liver ICU, Tertiary care hospital, Chennai

Study Population : ESLD

Data Collected : Baseline demographics, Nutritional status
  - Subjective Global Assessment (SGA)
  - Nutrition Data
## Baseline Demographics

<table>
<thead>
<tr>
<th></th>
<th>Mean ± Std</th>
<th>Range</th>
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<tbody>
<tr>
<td>Age (yrs)</td>
<td>45.4±9.32</td>
<td>30 - 58</td>
</tr>
<tr>
<td>Height (cms)</td>
<td>168.5±10.6</td>
<td>157 - 180</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>75.3±17.01</td>
<td>36 - 94</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.45±5.08</td>
<td>14.61 - 32.86</td>
</tr>
<tr>
<td>MAC (cms)</td>
<td>26.08±4.25</td>
<td>18 - 32</td>
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<tr>
<td>MELD</td>
<td>19.6±4.46</td>
<td>11 - 23</td>
</tr>
</tbody>
</table>
Baseline Nutritional Status

Well Nourished: 7%

Moderately Malnourished: 93%
Classification - Child Pugh Score

Child C 87%

Child B 13%
% Nutritional Target Achieved

- Calorie: 69%
- Protein: 49%
How did we achieve Nutrition Goals?

• Nutrition Monitoring
  • Oral intake was monitored using a food and fluid chart by the Nurses
  • Calorie Count – done by the Dietitian
  • Labs: Hb, Serum Albumin, Lymphocytes, Na, K etc.,
<table>
<thead>
<tr>
<th>Date</th>
<th>Amount Eaten</th>
<th>Date</th>
<th>Amount Eaten</th>
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**FOOD & FLUID CHART**

Name: ............................................................
UHID No: ..........................................................
Room No.: .................
Doctor: ..........................................................
Diet Prescribed: ..............................................

**Total Calorie Intake (approx):**
**Protein Intake (approx):**
**Remarks (If any):**

Signature of the Nurse:
Signature of the Dietitian:
How did we achieve Nutrition Goals?

• Nutrition Education
  – Educated on the salt and fluid restrictions
  – Emphasized on
    • Increased caloric and protein intake
    • Oral Nutrition Supplement (ONS)
    • Nocturnal tube feed suggested if oral intake is not adequate
Reasons for Deviation

• Salt & fluid restriction
• Fever, Infection & Abdominal Pain
• Hepatic encephalopathy
• Nausea
• Procedures
General recommendations

• Small frequent meals
• Monitor calorie count
• TPN - GI dysfunction is present
• Aggressive nutrition support
  - Highly Individualized
  - Minimize catabolism
  - Slow the deterioration of nutritional status
Post -operative state
Immediate Post - operative state

Nutrition Status is affected by

- Graft function
- Pre-existing malnutrition
- The stress response to surgery
- Catabolic effects of high dose steroids
Nutrition Care Plan

• Post OP Nutrient recommendations

Energy – 1.2 – 1.3 times BEE
  • BEE using Harris Benedict equation
  • AEE : 1.3×BEE

Protein - 1.3 – 2g / kg / day

• American Association for the Study of Liver Disease
Effect of Nutrition Support in the post liver transplant Indian Adult Patients

Study design : Single centre, Prospective
Study period : Jan - Sep’13
Sampling technique: Random
Sample size : 27 subjects
Setting : Liver unit, Tertiary care hospital
Inclusion criteria : All Indian adults who underwent transplant for the first time
Exclusion criteria : All paediatric and international pts

On admission, the demographic, biochemical, nutritional, and anthropometric details were noted
## Baseline Characteristics

<table>
<thead>
<tr>
<th>Characteristics of Patients</th>
<th>Mean±Std</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>47.5±9.59</td>
<td>25-60</td>
</tr>
<tr>
<td>Height (cms)</td>
<td>163.6±10.05</td>
<td>143-182</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>69.5±13.56</td>
<td>36-95.5</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>26.01±5.14</td>
<td>14.79-38.94</td>
</tr>
<tr>
<td>MAC (cms)</td>
<td>25.8±4.13</td>
<td>18-35</td>
</tr>
<tr>
<td>MELD</td>
<td>18.1±3.78</td>
<td>11 - 23</td>
</tr>
<tr>
<td>A/G Ratio</td>
<td>0.9±0.36</td>
<td>0.3 - 1.8</td>
</tr>
</tbody>
</table>
Objectives

• To study the effect of
  – disease severity on nutritional status and outcomes
  – nutritional intervention in A/G ratio, LOS in ICU and hospital and nutritional status of the patients
  – ethanol and non-ethanol related ESLD and type of transplant (DDLT and LDLT) in nutritional status and outcome
Type of Liver Transplant

- LDLT 30%
- DDLT 70%
Baseline Nutritional Status

- Well Nourished: 4%
- Moderately Malnourished: 96%
Classification - Child Pugh Score

Child C 67%

Child B 33%
% Calorie Achieved

<table>
<thead>
<tr>
<th>Days</th>
<th>Day-1</th>
<th>Day-3</th>
<th>Day-5</th>
<th>Day-7</th>
<th>Day of Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Calorie Achieved</td>
<td>37.78</td>
<td>68.93</td>
<td>82.4</td>
<td>89.78</td>
<td>94.9</td>
</tr>
</tbody>
</table>
Target Vs Achieved

- **Calorie**: 74.3%
- **Protein**: 60.3%
Results

• Strong correlation between the disease severity score (child) and the nutritional status (SGA) of the patients

• There was an improvement in weight and A/G ratio of the patients after nutritional intervention and was significant (p<0.001)

• Length of stay in ICU and Hospital were 9.9+/6.9 and 16.07+/10.78 respectively

• LOS of child - C class in the hospital (17.5 days) was comparatively higher than the child - B class (13.1 days)

• There is a strong correlation between the ethanol intake and the nutritional status (SGA) of the patients (p< 0.014)
Conclusion

• A protocolized nutritional support and close monitoring reduced the risk of adverse outcomes in our study population
How did we achieve Nutrition Goals?

• Nutrition Monitoring
  • Oral intake was monitored using a food and fluid chart by the Nurses
  • Calorie Count – done by the Dietitian
  • Labs: Hb, Serum Albumin, Lymphocytes, Na, K etc.,
  • Protocolized treatment plan
How did we achieve Nutrition Goals?

• **Nutrition Education**
  – Post transplant diet education
  – Emphasized on
    • Increased caloric and protein intake
    • Oral Nutrition Supplement (ONS)
    • Food hygiene and safety
Reasons for Deviation

- Surgical stress
- Fever, Infection & Abdominal Pain
- Nausea & Vomiting
- Procedures
THANK YOU