Nutrition Care of Liver Transplant Patients: Pre & Post Transplantation

Objectives:
- Nutrition Care of Liver Transplant Patients
  1. Nutritional Status and Malnutrition
  2. Nutrition Support
  3. Pre-Transplant Diet
  4. Early Post-Transplant Diet vs. Long-term Post-Transplant Diet
  5. Poor Intake Tips (Pre- and Post-Transplant)
  6. Micronutrient Deficiencies
1. Nutrition Status and Malnutrition

Prevalence of Malnutrition in Liver Disease

- Current estimates are 15-60%
- 90% of pts with cirrhosis
- 20% of compensated cirrhosis cases
- 50% of decompensated cases
- 57% of cirrhotic inpatients had malnutrition during their admission
- Every patient with alcoholic hepatitis/cirrhosis has malnutrition of varying severity
- 62% alcoholic subjects without liver disease were observed to have malnutrition
- 65-90% of patients with advanced liver disease suffer from malnutrition
- >95% of patients with ESLD + BMI >30-40 have sarcopenia determined on CT

Why Malnutrition in Liver Disease?

- Inadequate nutrient intake:
  - Loss of appetite, early satiety, delayed gastric emptying, bloating, abdominal distention, decreased alertness, N/V/D, restrictive diets, altered taste perception - linked to zinc deficiency
- Metabolic alterations:
  - Altered glucose, lipid and protein metabolism, energy consumption, decreased glycogen levels, reduced storage of nutrients
- Malabsorption/maldigestion:
  - Bile salt deficiency, small bowel bacterial overgrowth, portal hypertensive enteropathy

Pimentel et al., MCNA 2016
Mouzaki et al. JPEN 2014
Two Main Factors Contributing to Malnutrition:

- **Semi-starvation**
  - Inadequate intake
  - Increased requirements
  - Impaired absorption
  - Altered transport
  - Altered nutrient utilization

- **Systemic inflammatory response**
  - Inflammation
  - Hypermetabolic state
  - Hypercatabolic state

Malnutrition is Associated with the Following:

- Increased risk of pressure ulcers
- Impaired wound healing
- Immune suppression
- Increased infection rate
- Muscle wasting
- Functional loss
- Increased LOS
- High readmission rates
- Higher treatment costs
- Increased mortality

Etiology-based Malnutrition Definitions

- Starvation-Related Malnutrition
- Chronic Disease-Related Malnutrition
- Acute Disease- or Injury-Related Malnutrition
- PEU
Why Albumin and Prealbumin are Absent

Positive acute-phase reactants:
- Increased C-reactive protein, fibrinogen, procalcitonin

Negative acute-phase reactants:
- Decreased visceral proteins: albumin, prealbumin, transferrin

- Proxy measure for underlying disease burden and inflammatory condition
- Liver dysfunction and reduced synthesis of proteins
- Prealbumin has a shorter half-life than albumin but same issues
- Identifying the degree of inflammation is necessary
- Alb / prealb can be useful in absence of inflammation with adequate nutrition

White et al., JPEN 2012
Patel et al., NCP 2017

2. Nutrition Support

Benefits of Enteral Nutrition

- **Nutrition benefits of EN:**
  - Calories, protein, micronutrients and antioxidants
  - Substrate for protein synthesis
  - Supporting cellular and mitochondrial function

- **Non-nutrition benefits of EN:**
  - GI: gut integrity, reduce inflammation, motility/contractility, absorptive capacity, maintaining GALT mass/beneficial bacteria, trophic effect on epithelial cells, reduced virulence
  - Metabolic: insulin sensitivity, reduce glycosylation, fuel utilization
  - Immune: maintain MALT, modulate adhesion molecules and key regulatory cells, anti-inflammatory effects

Hasse and Gautam, 2017
Popular Enteral Formulas

- Peptamen 1.5 with prebio (replaced Peptamen 1.5)
  - Well-tolerated, concentrated formula while on CRRT
- Nepro
  - Concentrated formula with lower level of electrolytes for SPHD
- Peptamen AF
  - Well-tolerated, high-protein, anti-inflammatory formula
- TwoCal HN
  - Most concentrated formula, higher in fat
- Vital High Protein
  - Very high protein, isotonic; great for trickle feeds or trial of TF

Modular Enteral Products

- Fiber Additive: Nutrisource Fiber: 1 or 2 scoops
- Protein Additive: Beneprotein: 1 or 2 scoops
  - Should not be added to tube feeding bag
  - Require flushing before and after to reduce risk of clogging tube
  - Each administration should be documented in Care Connect
  - Flowsheets: Daily Cares tab: row below NUTRITION and above TUBE FEEDING

Tube Feeding Administration:
Mix scoop of powder with (80-120 mL) water until dissolved. Administer by syringe through feeding tube. Flush afterwards with a minimum of 30-60 mL water. Do not put additives in tube feeding bag.

Oral Administration:
Mix scoop of powder into at least 4oz of any warm or cold beverage or soft food, including purée. Stir until dissolved. Avoid mixing into acidic liquids like orange juice, sodas or lemonade.

Barriers to Adequate Enteral Nutrition

- Delays in ordering EN
  - Waiting on tube placement or calorie count results
- Initiation at low rate or stuck at trickle feed rate
  - Trickle feed = 360 kcals/day, hypocaloric feed = 1600 kcals/day
- Rate advanced too slowly
- Held too frequently
  - Held for GI bleed and variceal banding.
- Restart EN in 24-48 hours after GI bleed stops
- Held for elevated gastric residual volumes (GRVs)
  - Post-pyloric tubes recommended for HE and delayed gastric emptying
- Stopped too soon, patient not eating >50% of all meals
Parenteral Nutrition (PN) Guidelines

2016 SCCM/ASPEN Guidelines for the Provision and Assessment of Nutrition Support Therapy in Adult Critically Ill Patient recommends:

1. No PN for first 7 days in ICU for well-nourished patients
2. PN upon admission to ICU for severely malnourished patients
   a. Provide hypocaloric (20 kcal/kg or 80% of energy needs) x 1 week
3. No lipids for first week in ICU
   a. Or limit 100 gm per week if concern for essential fatty acid deficiency (typically occurs in ~3 weeks of inadequate EFAs)

Improved safety of PN: improved glycemic control, avoid overfeeding, use standard PN products and CVC care.

Parenteral Nutrition Best Practices

1. Use insulin to keep BG 140/150-180 mg/dL
2. Dextrose infusion rates < 4 mg/kg/min
3. Provide at least 1.2 gm protein/kg
4. Determine lipid use on individual basis
   a. Avoid EFAD
   b. Utilize SoyMctOliveFish (SMOF) lipids when indicated
5. Patients with cirrhosis often need:
   a. Additional thiamine, folate, zinc and less copper
6. Give IV thiamine (Vitamin B1) prior to starting PN

2. Diet for Liver Disease (Pre-Transplant)
**Nutrition Goals:**
- 35-40 kcal/kg (Adjusted / dry / ideal / actual body weight)
- No protein restriction = one of the causes of malnutrition (high protein)
- High risk of hypoglycemia (less glycogen stored / gluconeogenesis)
- Avoid fasting > 3-6 hrs during day; small, frequent meals through day
- Late evening snack with 50gm complex carbs for LBM retention

**To prevent or slow the advancement of liver disease:**
- Maintain a healthy weight
- Avoid alcohol
- Avoid excess iron intake (if iron blood level is in normal range)

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**UCLA Diet Orders**
- Low potassium diet: menu also low in Phos and Na
- 2 gram sodium diet: on low fat menu
- 1000 mg phosphorous diet: may not be necessary
- Carbohydrate controlled diet: grams of carb on menu
- Mechanical soft diet: cut up and soft foods for dentition
- Thickened liquids: unpalatable, risk of dehydration
- Puree diet: premade foods
- Fluid restriction: 1L, 1.5L- can reduce nutrition intake
- Coffee, juice, milk, ice cream, soup, gelatin, popsicles, sherbet and oral nutritional supplements (ONS) like Nepro. Ensure count

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**Well-documented Calorie Counts Help**

**Calorie Count Best Practices:**
- All meal receipt slips marked with amount after every item:
  - Choices: None, ¼, ⅓, ½, All
- All missed meals/snacks denoted and include why
- Any other non-meal foods on Caloric Intake Form
  1. Outside foods brought in (or ordered in)
  2. Snacks between meals, from UCLA or family
  3. Oral Nutrition Supplement (ONS) drinks
  4. Anything else consumed between/after meals
Examples of Appropriate Meal Intake Percentages

<table>
<thead>
<tr>
<th>Refused—0%</th>
<th>Poor—25%</th>
<th>Fair—50%</th>
<th>Good—75%</th>
<th>All—100%</th>
</tr>
</thead>
</table>

Modified for presentation. Accessed 7/11/2018
https://www.consultant360.com/n411/content/meal-intake-guide-supported-abbott-nutrition

Mullin et al., GI and Liver Disease, 2012
ACS Guidelines on Nutrition for Cancer Prevention

4. Early Post-Transplant Diet vs. Long-term Post-Transplant Diet
Post-Operative Nutrition

• Ideal: Clears / Diet for PONV vs. TF (if malnourished) ~12-24 hrs, if stable
• Common: Stable / extubated / await bowel function / safe to swallow?

UCLA diet order options after advancement from Clears

• Low Potassium: (until K+ trends <5.0)
  - This menu is also low phos and low sodium
• Carbohydrate Controlled: (if on insulin post-op)
  - this menu is also low salt/fat--RD can liberalize if needed
• 2 Gram Sodium:
  - Typically not unless post-transplant ascites, excessive fluid retention
• Mechanical Soft / Pureed: (Texture-dysphagia, per SLP)
  - If patient has not had a recent swallow eval for upgrades – ask!

If patient not meeting >60% estimated goal in 1st week - add TF!

Transplant Food Safety Menu Insert

Does the patient / family have a copy of the
TRANSPLANT FOOD SAFETY MENU INSERT?

Food Safety Review - Post-OLT

The following tips will lower the risk of foodborne illness.

1. Wash hands well and frequently with soap and water
   Before handling foods and especially after handling pets, garbage,
   gardening, using the restroom and between handling raw and cooked
   foods.
2. Do not eat raw or undercooked meat, fish, poultry or eggs
   This includes: sushi, ceviche, steak tartare, raw cookie dough, Caesar
   salad dressing prepared with raw eggs, raw milk and cheeses made
   with raw milk. Undercooked shellfish is especially dangerous for liver
   patients. Runny egg yolks (over-easy) okay if using pasteurized eggs
   (+UCLA).
3. Defrost frozen foods in the refrigerator or in the microwave
   Not on the counter or in the sink. Do not refreeze defrosted, uncooked
   foods (okay to freeze after cooking). Families should practice at home.
The following tips will lower the risk of foodborne illness.

4. Wash fresh fruits and vegetables well before eating
   Any brought in by family/friends should be washed well. Patients may use a scrub brush if desired. Throw away outer leaves of leafy vegetables such as lettuce and cabbage.

5. Cook and store foods at proper temperatures
   Keep foods at safe temperatures: hot foods above 140°F and cold foods below 40°F. Keep perishable foods out the fridge for no longer than 1-2 hours. Any foods served that should be kept in the fridge should be eaten within 1-2 hours.

6. Check expiration dates and do not consume expired foods
   Leftovers should be eaten within 1-2 days.

7. Do not use canned goods that are swollen/dented/damaged
   Wash lids before opening cans / sparkling waters (or sodas if okay).

8. Use separate cutting boards for raw and cooked foods
   Sanitize work surfaces, knives, utensils, and cutting boards before using them to serve cooked foods. Families should practice at home.

9. When shopping, pick up perishable items last
   Refrigerate all perishable foods within 2 hours.
The above is included in the Post-Transplant Nutrition Packet – provided in the class taught by the Dietitian (Wednesdays 1:30pm). Families can sign up with in-house Coordinator to attend.

Post-Transplant Nutrition / Diet Goals

Post-Transplant [Temporary*] Low Potassium Diet

- Immunosuppressant transplant medication = high K+
- Medication adjustments ~1 month in Thursday clinic
- Low potassium diet starts at discharge from UCLA
  - We can treat elevated K+ if too high in-house, to encourage PO
  - If K+ trending >4.8/4.9 ongoing, may add Low K+ diet at hospital

- How long does the pt follow a Low K+ diet?
  - Two weeks to three months (or more) when home after transplant.

*The dietitian (Jennifer Krohn) in clinic, will confirm when it is safe to start adding high potassium foods back into the diet.
Long-term Post-Transplant Diet (> 3 months)

- After Three Months of Being HOME (after discharge)
  - Heart Healthy: (Na + Fat control, All patients after home x3 mos)
    - Due to risk of CVD / HTN / +/- with DM
    - Hopefully the patient’s potassium has normalized
  - +/- Carb Controlled: (Monitoring carbohydrate portions)
    - If elevated BG
    - Common if prior +DM
    - Steroids obviously exacerbate, but may improve with time

→ Along with: Food Safety for life

5. Poor Intake Tips - for UCLA & HOME (Pre- and Post-Transplant)

High Calorie/Protein Snacks

- Hard boiled eggs or egg salad with mayo
- Tuna or chicken salad with extra mayo
- ½ sandwich made with fresh chicken/turkey
- Fruit with ½ cup low sodium cottage cheese, or ricotta cheese
- 2 slices mozzarella cheese with unsalted crackers
- Cooked quinoa (or coffee/tea) with protein powder + vanilla MCT oil blended in ½-chromed
If Patients are Unable to Eat Enough Food

- Oral Supplements at UCLA

<table>
<thead>
<tr>
<th>Name</th>
<th>Calories/Protein (per 30mL)</th>
<th>Flavors Available In-House</th>
</tr>
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<tbody>
<tr>
<td>Aspargiv</td>
<td>420 kcal</td>
<td>Vanilla, Butter, Cinnamon, Flavored</td>
</tr>
<tr>
<td>TPN</td>
<td>420 kcal</td>
<td>Vanilla, Butter, Cinnamon, Flavored</td>
</tr>
<tr>
<td>Bradorhigh Protein</td>
<td>420 kcal</td>
<td>Vanilla, Chocolate, Cinnamon, Flavored</td>
</tr>
<tr>
<td>Ensure Formula</td>
<td>420 kcal</td>
<td>Vanilla, Chocolate, Cinnamon, Flavored</td>
</tr>
<tr>
<td>Nutren</td>
<td>420 kcal</td>
<td>Vanilla, Chocolate, Cinnamon, Flavored</td>
</tr>
<tr>
<td>Nutren High Aliment</td>
<td>420 kcal</td>
<td>Vanilla, Chocolate, Cinnamon, Flavored</td>
</tr>
<tr>
<td>Ensure Care</td>
<td>420 kcal</td>
<td>Apple, Mixed Berry, Cinnamon, Flavored</td>
</tr>
</tbody>
</table>

*Vitamin and Mineral Supplements (only) provide information per fluid oz.; *as indicated. *Use prescribed volume as outlined. *Use prescribed volume as outlined. *Use prescribed volume as outlined. *Use prescribed volume as outlined.

Homemade High Calorie/Protein Drinks or Shakes – Recipe Ideas:

- 8 oz Almond, Soy, Coconut, Oat, Rice, Hemp, Quinoa, or Cashew Milk, or a type of Dairy (Goat/Cow) Milk (or sheep milk yogurt + ice)
- Mixed with plain Whey or Pea protein powder (or other plain, Plant-based protein powder)
- For Flavoring + Nutrients, consider adding:
  - Fresh or frozen fruits – especially dark berries
  - Ground spices: Ceylon cinnamon, ginger, nutmeg
  - Fresh herbs (mint), or roots (ginger/turmeric)
  - Vanilla/mocha/pod/mCT oil (non-emulsified)
  - Avocado and/or nuts/seeds
6. Micronutrient Deficiencies

Main Micronutrients to Focus on 1st in Liver Patients

Thank you.