In this session we will discuss the most important component of the surgical nutrition process – the NUTRITION CARE PLAN

The objectives are:

- To discuss the process and mechanics of the nutrition care plan for surgical patients
- To discuss the role of the nutrition team in formulating and carrying out the nutrition care plan
How is the nutrition care plan designed, formulated, and carried out?
The surgical nutrition process:

- All admitted patients are nutritionally screened
- All nutritionally at risk patients are assessed
- All high risk patients are given nutrition care plans
- Monitoring of the nutrition process is done
- Nutrition care plan modification / Discharge

The NUTRITION CARE PLAN is the third step in the surgical nutrition process:

- Nutrition screening is the first step – all patients are screened to identify the “nutritionally at risk”
- Nutrition assessment is the second step – all identified “nutritionally at risk” will be classified as mild, moderate, or high risk
- The third step is the NUTRITION CARE PLAN which consists of three main components:
  - Designing
  - Formulating – implementation part
  - Carrying out – implementation part
- The fourth step is the monitoring process of the nutrition care plan implementation
- The fifth step is the reassessment of the nutrition care delivery process and revision of the nutrition care plan if needed
This is the nutrition care plan form. It contains all the components of the nutrition management for the surgery process.
Nutritional status

- Severely malnourished?
- Feeding access? Oral, GIT, parenteral, combinations
- Need to build up before surgery?
- Is there a need for special nutrients?

These are the initial components of the nutrition care plan – to design the nutrition regimen based on the nutritional status of the patient and the magnitude of surgery. These are the issues:

- Is the patient severely malnourished?
- Is there a need for a feeding access? Oral, GIT, parenteral, combinations?
- Is there a need to build up the patient before surgery?
- Is there a need for special nutrients?
This is the clinical nutrition decision making process designed for surgery as recommended in the guidelines for surgery by the European Society of Clinical Nutrition and Metabolism in year 2009 (formerly ESPEN).

- Please note that in the identified major surgeries nutrition build up with supplementation of immunonutrition is recommended even if the patients are nutritionally assessed to be normal.
- The postoperative phase is characterized by the following:
  - Emphasis on early feeding
  - Placement of access for feeding (jejunostomy) when oral intake recovery is not expected beyond one to two weeks
  - Supplemental parenteral nutrition when the patient’s actual intake falls below 60%
Surgical nutrition pathways: Pre-operative phase

Condition: When oral or enteral feeding not possible

**Normal to moderate malnutrition**

- Parenteral nutrition + Omega-3 Fatty Acids + Antioxidants (+ glutamine); 6-7 days

**Severe Malnutrition**

- Esophageal resection
- Gastrectomy
- Pancreaticoduodenectomy


This is the decision making process when the patient cannot have oral or enteral feeding pre-operatively. Note that the parenteral nutrition regimen contains all macro and micronutrients and pharmaconutrients.

Surgical nutrition pathways: Intra & Post-operative Period

While in the OR ask yourself: “Is oral feeding possible within 7 days?”

**Yes**

- Can I feed within 4 days?
  - Yes
    - “Fast Track”
  - No
    - PN
    - Transition

**No**

- Needle catheter jejunostomy
  - Enteral nutrition (12 hrs)
  - Better: immunonutrition
  - If enteral nutrition is inadequate
    - Supplemental PN


These are the surgical access decision making process one has to make before closing up the patient. It is recommended that the question of gut recovery for feeding and the need for special access be addressed while in the operating room.
These are the components of the nutrition care plan:

- Total calorie requirement for the day – this is based on the discussions made earlier especially based on guidelines of the major nutrition societies globally (ASPEN, ESPEN, PHILSPEN) – from the macronutrients (carbohydrates, fat, protein)
- Total protein requirement for the day (protein)
- Electrolytes
- Vitamins – water and fat soluble vitamins
- Trace elements
- Pharmaconutrients – includes glutamine, fish oils, antioxidants, and arginine

The choices come hand in hand with the recommended standard values or specific requirements for the patient (“tailor fit”)

The nutrition team responsible for these decision making values are:

- Physician
- Dietitian
- Nurse
- Pharmacist
Total calorie and protein requirement

- **Guidelines:**
  - Nutritional status – if severely malnourished
    - Calories: 20 to 30 kcal/kg body weight
    - Use actual body weight if not obese
  - Capacity to undergo surgery
    - Normal or low malnutrition level: immediate surgery

For total calorie and protein requirement these are the guidelines:

- Nutritional status – if severely malnourished
  - Calories: 20 to 30 kcal/kg body weight
  - Use actual body weight if not obese
- Capacity to undergo surgery
  - Normal or low malnutrition level: immediate surgery guidelines:
For the non-protein calories (=responsible for the main energy provision), these are the issues that need deciding on:

- **Ratio of glucose to lipid content** – glucose preference for trauma and more lipid preference for sepsis
- **Issue regarding type of lipids**
  - Saturated vs. unsaturated
  - Long chain vs. medium chain triglycerides
  - Omega-3 vs. omega-6 PUFA, how about omega-9?

Saturated vs. unsaturated – energy priority (MCT) or immunomodulation (EPA/DHA)

Long chain vs. medium chain triglycerides (LCT is needed for cellular function; faster delivery and utilization in the tissues for MCT)

Omega-3 vs. omega-6 PUFA, how about omega-9? (less inflammatory or pro-inflammatory?)
Micronutrients

- Electrolytes
  - Laboratory values
  - Drug-nutrient interactions
- Vitamins
  - Water and fat soluble vitamins
- Trace elements

Micronutrient delivery
- Electrolytes
  - Laboratory values: Na, K, Cl, Mg, P
  - Drug-nutrient interactions
- Vitamins
  - Water and fat soluble vitamins
- Trace elements
These are the rest of the nutrition care plan:

- **Formulation** – do you prepare a special diet? Do you need oral supplementation, enteral or parenteral formulation? (=the physician, dietitian, and pharmacist are involved here)

- **Access route**: (=it is the physician or nurse who are the point persons here)
  - Enteral: oral, tube fed (gastrostomy? Jejunostomy?)
  - Parenteral: peripheral? Central?

- **Method of delivery**: (=the nurse, dietitian, or pharmacist are involved here)
  - Enteral nutrition - Bolus or gravity drip feeding? Pump driven?
  - Parenteral nutrition – preferably infusion pump driven

- **How do you monitor the nutrition delivery process**? (all the members of the nutrition team are involved here)
  - Fluid balance especially accumulated fluid balance – zero balance or increasingly positive?
  - Calorie and protein balance? Are the goals met?
  - Electrolytes: Na, K, Mg, Ca, P (=checking for “refeeding syndrome”)
  - Weight once a week?
  - Serum albumin, prealbumin, nitrogen balance
Formulation

- Oral supplementation
- Enteral nutrition
  - Standard vs. special nutrition
  - Supplemental vs. meal replacement
  - Issue of blenderized diets
- Parenteral nutrition
  - Supplemental vs. total PN
  - Need to include micronutrients in all solutions
  - Special nutrients (e.g. pharmaconutrition)

Issues on formulation:
- Oral supplementation – is this needed or is this enough to increase total intake for the day?
- Enteral nutrition - this is always the priority as stated in the algorithm
  - Standard vs. special nutrition
  - Supplemental vs. meal replacement
  - Issue of blenderized diets
- Parenteral nutrition
  - Supplemental vs. total PN
  - Need to include micronutrients in all solutions
  - Special nutrients (e.g. pharmaconutrition)
Enteral nutrition issues

<table>
<thead>
<tr>
<th>Commercial Formulas</th>
<th>Blenderized Formulas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniform contents</td>
<td>Daily nutrient variability</td>
</tr>
<tr>
<td>Sterile</td>
<td>Non-sterile; high bacterial content and other pathogens</td>
</tr>
<tr>
<td>Low viscosity</td>
<td>High viscosity</td>
</tr>
<tr>
<td>Lactose free</td>
<td>Does not provide adequate caloric density</td>
</tr>
<tr>
<td>Defined caloric density</td>
<td></td>
</tr>
</tbody>
</table>


Here is the issue on blenderized diets:
- Contents of commercially-prepared formulas are uniform. In contrast, content can vary considerably in blenderized formulas, depending on the basic ingredients.
- Commercial formulas are prepared in an aseptic environment and are sterile. They are sold in liquid form, ready to administer, which greatly reduces the risk of contamination. Blenderized formulas, on the other hand, are produced within the institution which increases the risk of bacterial contamination. If the formula becomes contaminated, the patient often suffers diarrhea and other GI symptoms.
- Blenderized formulas also have the disadvantage of being more viscous, increasing the risk of tube clogging.
- They may also contain lactose, which is contraindicated in some patients. Therefore, the use of commercially-prepared formulas is generally safer and more cost-effective.
<table>
<thead>
<tr>
<th>Pharmaconutrition</th>
<th>Dose</th>
<th>Content in preps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutamine</td>
<td>0.4 – 0.5 g/kg</td>
<td>12 – 15 g/L</td>
</tr>
<tr>
<td>Arginine</td>
<td>?</td>
<td>4 – 16 g/L</td>
</tr>
<tr>
<td>Omega-3-fatty acids (EPA)</td>
<td>2 – 6 g/day</td>
<td>1 – 2 g/L</td>
</tr>
<tr>
<td>Antioxidants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carotenoids</td>
<td>&gt;100% daily requirement</td>
<td>Single or combinations</td>
</tr>
<tr>
<td>Vitamin C,E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please take note of the doses of these pharmaconutrients:

- Glutamine is usually given as part of the total protein requirement
- Arginine is always needed especially for immune function and perfusion
- Omega-3-fatty acid dose may reach as high as 15 g/day and usually this is delivered by intravenous infusion
- Antioxidants are needed daily and increased in dose when energy expenditures increase
Access and delivery

- Enteral:
  - Short term vs. long term
  - Need for enteral pumps
- Parenteral
  - Peripheral vs. central
  - Single or multiple lumen catheters
  - Protocols for maintenance

These are the access and delivery issues:
- Enteral:
  - Short term vs. long term (cut off from NGT to PEG access = 3 weeks?)
  - Need for enteral pumps (=jejunostomy feeding is better with enteral pumps)
- Parenteral
  - Peripheral vs. central (=one week of PN? More than 2-3 weeks?)
  - Single or multiple lumen catheters (=at least two lumen catheters are recommended to ensure continuous parenteral nutrition delivery)
  - Protocols for maintenance
The surgical nutrition process

- All admitted patients are nutritionally screened
- All nutritionally at risk patients are assessed
- All high risk patients are given nutrition care plans
- Monitoring of the nutrition process is done
- Nutrition care plan modification / Discharge

The details of the monitoring process will be discussed in the following slides

Monitoring issues

- The team performs the calorie count and fluid balance
- The fluid, calorie, and protein intake are recorded and adequacy of intake is recorded in the patient’s chart

These are the people, equipment, and forms involved in the monitoring process.
The main source of the monitoring information is the patient’s intake and output record. The data from this record is modified and placed in the calorie, protein, and fluid balance form.

The nutrient monitoring form will summarize the total calorie and protein requirement, the details of the sources of calorie and protein taken by the patient and finally the percentage of the actual intake which will indicate whether the patient has adequate or inadequate intake.
How to implement

• Monitoring: everyone is involved

Here is a sample of the completed nutrient monitor form. Note the values.
Monitoring

• Fluid balance – avoid fluid accumulation within 4-5 days post op
• Calorie balance
• Gastric retention for enteral nutrition
• Blood tests:
  – BUN high – dialyze
  – High triglycerides – lower lipid flow
  – Hyperglycemia – insulin
• Weight once a week

Finally these are the key monitoring variables of the nutrition care plan:
• Fluid balance – avoid fluid accumulation within 4-5 days post op
• Calorie balance
• Gastric retention for enteral nutrition (=currently the value for slowing or stopping the feeding for 30 minutes to one hour is 150 to 200 ml )
• Blood tests:
  • BUN high – dialyze
  • High triglycerides – lower lipid flow
  • Hyperglycemia – insulin
• Weight once a week (weigh daily if accumulated fluid balance is high @2 liters)
We now focus on the nutrition team. It is the gold standard for achieving adequate nutrition management for the surgical patient in the hospital setting. The main reason is the team utilizes all the special skills of its specific members – from the physician who is the team leader to the rest of the team: clinical dietitian, nurse, and pharmacist – to delivery optimum nutrition to the patient.
The team activity essentially covers the whole nutrition delivery and reporting of outcomes for the whole department or hospital. These are:

- Policies and guidelines are initially formulated for the delivery of the clinical nutrition process
- Once guidelines are in place the team goes on patient rounds at least 3x a week
- For difficult patients a nutrition team meeting has to be called
- All nutrition management data are encoded and compiled for the weekly or monthly reports; this includes study data for research purposes
- Regular updates on clinical nutrition practices are done either locally or abroad
In essence these are the outcome data that can be reported from the clinical nutrition process:

- From the screened and assessed patients
  - Malnutrition rate (underweight and obese)
  - Severe weight loss profile for patients

- From the nutritionally at risk patients
  - Severely malnourished surgical patients
  - Who are the patients with poor intake – effect of nutrition care
  - Outcome (=morbidity, mortality) correlated with adequate intake, use of pharmaceuticals
  - Are the suggestions carried out by the attending physicians? (=suggestions on early feeding, fluid management, access and formulation)
This study on reduction of mortality in critical care patients was achieved:
• when calories delivered reached 1000 kcal and more
• when protocols on feeding for the ICU were developed and carried out by a nutrition team
• The key process was the nutrition team monitoring system of the nutrition care delivery process
Our local data shows a similar outcome: when adequate intake was achieved in both energy and protein there was no difference in mortality outcome. Most of the high risk patients had critical care status during their periods of treatment.