



# Nutrition in surgical patients

## Objectives:

- Not given

## Resources:

- Lecture slides
- Davidson's
- Surgical recall

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COLOR INDEX:

NOTES , IMPORTANT , EXTRA , DAVIDSON'S

EDITING FILE

FEEDBACK



# Nutrition

## Nutrition Therapy

In the surgical patient, the indications for nutritional therapy are prevention and treatment of catabolism and malnutrition. This affects mainly the perioperative maintenance of nutritional state in order to prevent postoperative complications.

### Aims of Nutrition in surgery :

- Prepare / Enhance recovery.
- Prevent malnutrition or diet related consequences ,( eg,nausea, vomiting, diarrhea,dumping syndrome and dehydration).
- Define patients who are at risk and who needs for nutrition support.
- Define special nutrition needs for patients undergoing major surgeries e.g. for cancer (especially colon cancer).

### Nutrition care for patient undergoing surgery is vary, in related to:

- The type of surgery (Minor, Major, Elective, urgent). The minor surgery usually don't need nutrition support and they will restore their oral intake immediately after surgery. The major surgery takes a long time, so the recovery after surgery can take time, which will affect the patient's nutrition (one of the good examples is bowel resection).
- The require OF extensive nutrition support.
- Route of Nutrition, orally or via TF (tube feeding).
- Postoperative complications such as obstruction, fistula, or anastomotic leaks, delayed recovery, those complications affect the nutrition so they need nutrition support usually by TF.

# Malnutrition

## • Malnutrition:

- Is a broad term that can be used to describe any imbalance in nutrition; from overnutrition (Why is overnutrition considered as a malnutrition? for example in renal patients if you give them overdose of proteins, it will be considered malnutrition) to under-nutrition.
- Observed up to 40-60% of surgical patient on admission/remains under-diagnose in 70% of patient in hospital settings. Why? Because the priority of the patient is not to solve their nutrition problem but to have the surgery, and sometimes there is shortness of staff and that will increase the risk of complications.
- Malnutrition seen in hospitalized patients is often a combination of cachexia (disease-related like in cancer patients) and malnutrition (inadequate consumption of nutrients 'poor intake') as opposed to malnutrition alone.



## HOW TO DETECT PATIENT AT RISK:

Nutritional risk screening in all patients on hospital admission or first contact:

- BMI <18 kg/m<sup>2</sup> some types of surgeries affect the patient's weight even if the patient was able to eat orally.
- Combined: weight loss >10% or >5% over 3 months and reduced BMI or a low fat free mass index (FFMI).
- Combined BMI < 18 and weight loss >2- 3% over 3 months.
- **Preoperative serum albumin < 30 g/l** (with no evidence of hepatic or renal dysfunction).

## Surgery:

- Injury → altered metabolism which will increase:
  - Stress hormones.
  - Inflammatory mediators: cytokines.
- Catabolism of:
  - Glycogen → glucose.
  - Fat → fatty acid, glycerol.
  - Protein → amino acid.
- Substrates for:
  - Immune response
  - Physical activity/rehab → need anabolism
  - Healing → need anabolism

So if the patient didn't have enough nutrition during the catabolic state that will affect those substances above, so they will be more prone to have infection, poor healing, and muscle wasting<sup>1</sup> which may present as difficulty swallowing, which may lead to aspiration pneumonia (commonly seen after sleeve).

Malnutrition Adverse Effects	
Impaired wound healing.	Impaired Immune function and increase risk for infection.
Thoracic muscle mass wasting depresses respiratory efficiency and increases the risk for pneumonia.	Albumin level decrease leading to generalized edema.
Small bowel mucosa atrophy.	Impaired mental function leads to depression, due to decrease in amino acids which happens in prolonged surgery (the intake is effected)
Postoperative complications rate is higher.	Prolong recovery time and longer hospital stay.

<sup>1</sup> It is basically due to protein catabolism, that's why we measure albumin and give protein after surgery to prevent muscle wasting.



# Laboratory Measures

- Serum proteins such as **albumin and prealbumin**. Albumin is the most important indicator of nutrition before surgery, but it could give false positive in case of renal or liver problems, so in this case we will use prealbumin, so **prealbumin is more accurate than albumin**.
  - Albumin needs 23 days (males doctor said 28 days) to peak, so it is helpful to measure the nutrition status in months.
  - Prealbumin gives an estimation about the patient's nutrition status in the last 7 days.
- Transferrin. For iron status
  - Transferrin gives an estimation about the patient's nutrition status in the last 3 days.
- Nitrogen balance (creatinine and BUN) in case of muscle wasting.
- Electrolytes.
  - Electrolytes are the **second most important indicator** of the patient's nutrition.
  - **K (potassium) is the most important electrolyte in nutrition**, if the patient has been on clear fluid for 2 days, they usually develop hypokalemia, that's why we shouldn't put patients on clear fluid for long time.
- Total cholesterol. In malnutrition the LDL + HDL are low.
- Indicators of inflammation<sup>2</sup> such as:
  - C-reactive protein (CRP).
  - Total lymphocyte count (TLC).

## Nutrition status pre/post surgery

### Preoperative nutritional care:

- Nutritional "metabolic" risk and disease-related malnutrition.
- Assessment before surgery means risk assessment.

### Postoperative management of metabolism and gut function:

- Insulin resistance is a response mechanism to starvation predominantly caused by the inhibition of glucose oxidation.
- It is a protein sparing evolutionary "survival" mechanism.
- Some degree of insulin resistance develops after all kinds of surgery<sup>3</sup>, but its severity is related to the magnitude of the operation and development of complications e.g. sepsis.

<sup>2</sup> Usually if they are **High** this means there is low protein, so that patient will need a high protein nutrition support.

<sup>3</sup> That's why we start the nutrition after surgery as soon as possible to prevent the insulin resistance.



<b>PRE-op</b>	<ul style="list-style-type: none"><li>● Fasting from midnight is unnecessary in most patients.</li><li>● ALLOW clear fluids until two hours before anaesthesia. patient will be on clear liquid (simple carbs with no proteins) and fast only 2 hours before anaesthesia, why? Because simple liquids are easily absorbed and will be out of the system only after 2 hours of ingestion, so no need to put patient on NPO for a long time.</li><li>● Nutritional Support prior to major surgery, appropriate period of (7-14) days, For patient with severe nutrition risk.</li></ul>
<b>POST-op</b>	<ul style="list-style-type: none"><li>● Oral intake, including clear liquids, can be initiated within hours after surgery in most patients.</li><li>● Early tube feeding (within 24 h) shall be initiated in patients in whom early oral nutrition cannot be started, and in whom oral intake will be inadequate (patients undergoing major head and neck surgery or gastrointestinal surgery for cancer, patients with obvious malnutrition at the time of surgery).</li><li>● We try to minimize the duration on NPO because it might increase the probability of gut infection, decrease patient's appetite after removing the TF, increase nausea and vomiting and diarrhea and bloating after surgery.</li></ul>

### 'ERAS' Enhance Recovery After Surgery:

- **Enhanced recovery** of patients **after surgery** ("ERAS") has become an important focus of perioperative management.
- The ERAS protocol includes a metabolic strategy to reduce perioperative stress and improve outcome. ERAS guidelines recommend liberal subscription of oral supplements pre- and postoperatively.
- **ERAS protocols support early oral intake for the return of gut function.**
- From a metabolic and nutritional point of view, the key aspects of perioperative care include:
  - **Avoidance of long periods of pre-operative fasting.**
  - Re-establishment of oral feeding as early as possible after surgery. (Why do we need to Reestablish oral feeding? To **prevent Insulin resistance**).
  - Start of nutritional therapy early, as soon as a nutritional risk becomes apparent.
  - Integration of nutrition into the overall management of the patient metabolic control, e.g. of blood glucose.
  - Reduction of factors which exacerbate stress-related catabolism or impair gastrointestinal function.
  - Early mobilization to facilitate protein synthesis and muscle function.



# Nutrition support<sup>4</sup>

## Who Needs :

- Patient at Nutrition risk/or Malnourished<sup>5</sup>.
- Postoperative complications:
  - Ileus more than 4 days.
  - Sepsis.
  - Fistula formation.
  - Massive bowel resection.
  - Intractable vomiting;
- OTHER CONDITIONS like Maxillofacial and **esophageal surgery** require **tube feeding** quickly after surgery.
- In the picture above you can see some of the most commonly used formulas, the name of the formula gives a hint about the indication of it, for example:
  - **Glucerna**: for diabetic patients.
  - **Nepro**: for renal patients.
  - **Ensure**: which is the most common formula used.
- Some of them are full meals, the patient will take them once a day (calories are 2000-3000) others have less calories (400).



## Modes Of Administration

### What Route should be used?

The nutritional needs of patients are met through:

- **Parenteral (PN)** e.g. **TPN** (on central line) and peripheral nutrition: via IV line, it will give very small amount of nutrition.
- **Enteral (EN)** more preferred, e.g. JT (Jejunal tube).
  - Enteral nutrition prevents gut mucosal atrophy and subsequent bacterial translocation.

“Enteral nutrition should be first choice for nutritional support in the critically ill surgical patient”

<sup>4</sup> It is for patients NOT on oral intake or on oral intake put their intake is so poor so they need supplement (50% of the requirement), we like to start by oral intake first before going to tube because it will decrease the stress on the patient.

<sup>5</sup> Taking in consideration the patient's BMI and albumin level (if they decrease that will increase the risk).



## Enteral Tube feeding:

Enteral feeding should be used in preference to parenteral nutrition (PN) whenever possible:

Indications	Contraindications
<ul style="list-style-type: none"> <li>● Malnourished patient expected to be unable to eat adequately for &gt; 5-7 days.</li> <li>● Adequately nourished patient expected to be unable to eat &gt; 7-9 days. (Maxillofacial and esophageal surgery).</li> <li>● Adaptive phase of short bowel syndrome<sup>6</sup></li> <li>● Early oral nutrition cannot be started, (patients undergoing major head and neck or gastrointestinal surgery for cancer, severe trauma, including brain injury, patients with obvious malnutrition at the time of surgery, patients on a ventilator).</li> </ul>	<ul style="list-style-type: none"> <li>● Intestinal obstructions or ileus.</li> <li>● Severe shock.</li> <li>● Intestinal ischemia.</li> <li>● High output fistula.</li> <li>● Severe GI bleeding.</li> </ul> <p>Why? Because in EN the nutrition needs to pass through the GI before going to the blood, in those cases the nutrition can't go to the blood because the GI has an issue</p>

## Parenteral Nutrition:

Indications	Contraindications
<ul style="list-style-type: none"> <li>● Ileus.</li> <li>● Intestinal fistula (high-output).</li> <li>● Initial phase in case of short bowel or after small bowel transplant or during periods of rejection.</li> <li>● <b>PN should only be initiated if the duration of therapy is anticipated to be &gt;7 days.</b> (Bowel rest indicated for more than 7 days).</li> <li>● <b>IN some cases, Combined EN/PN showed clinical benefits</b> when compared with EN or PN alone.</li> <li>● If Open peritoneal cavity and enteral nutrition is contraindicated: <ul style="list-style-type: none"> <li>○ Massive small bowel resection (more than 70% of small intestine)<sup>7</sup>.</li> <li>○ Short-gut syndrome from previous disease.</li> <li>○ Active inflammatory disease of the intestine in which malabsorption is present (e.g. active crohn's) or Enterocutaneous fistulas.</li> <li>○ High output enterocutaneous fistula that is or has been stimulated by enteral nutrition.</li> <li>○ Colocutaneous fistula requiring more than 7 days of bowel rest.</li> <li>○ Enteral feeding access not possible because of one of the following conditions that happen due to surgical complications or cancer: <ul style="list-style-type: none"> <li>■ Obstructing gastrointestinal lesions (in the pharynx or esophagus).</li> <li>■ Gastric outlet obstruction.</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Functional gastrointestinal tract.</li> <li>● Colonic ileus (not a dysfunctional gut).</li> <li>● Awaiting flatus or bowel sounds following surgery because it normally takes time (inappropriate practice to evaluate bowel function).</li> <li>● Patient does not want to eat or does not want a feeding tube.</li> <li>● Fewer than 7 days of PN therapy, clear fluid will be enough for them.</li> <li>● One of the side effects of TPN is Thrombophlebitis.</li> </ul>

<sup>6</sup> After massive bowel resection (resection of > 100 cm from jejunum or the remainder bowel is less than 40cm of the jejunum) we immediately give the patient PN until they reach the adaptive phase then we put them on EN.

<sup>7</sup> Sometime patients will not reach to adaptive phase so they will be on home PN, they have oral intake but it is so poor they may get malnourished, so they need PN.



# Assess nutrition needs

## Energy and protein needs :

BMI (kg/m <sup>2</sup> )	Weight (kg)	Kcal/kg	Protein* (gm/kg)
< 30	Actual	20-25 (minor) 25-30 (major)	1g/kg/day (minor) 1.5-2.0 (major)
30-50	Actual	11-14	1.9-2.0 (IBW) (Ideal body weight)
> 50	Ideal	22-25	2.5 (IBW)

- In case the patient is underweight ( < 18.5 BMI), we should give him the nutrition according to his Ideal weight to avoid malnutrition.

## Protein Needs for Adults based on Albumin level and special conditions:

Condition	Albumin level	Protein requirement
Normal nutrition (Healthy adults)	3.5 gm/dL	0.8 to 1 gm/kg/day
Normal nutrition (Elderly adults)	>3.5 gm/dL	0.8 to 1 gm/kg/day
Mild depletion	2.8-3.5 gm/dL	1 -1.2 gm/kg/day
Moderate depletion	2.1-2.7 gm/dL	1.2-1.5 gm/kg/day
Severe depletion	2.1 gm/dl	1.5-2 gm/kg/day

# Fluids needs

Age (years)	ml/kg	Increased Fluid needs (30-35 ml/kg actual BW): short gut syndrome, high output ileostomy or fistula, excessive diarrhea, high NGT output, large draining wounds, chest tube and JP drain losses.
18-65	30-35	
65+	25 -30	

## Calculating Fluid Needs for Obese (BMI ≥ 30)

Adjusted Weight (The difference between the ideal and the actual)	Fluid per day	OR 30-35 ml/kg Adjusted body weight with allowances for extra losses via drains (draining wounds, chest tube and JP drain losses)
40-60 kg	1500 - 2000 ml	
60-80 kg	2000 - 2500 ml	
> 80 kg	2500 - 3000 ml	





# Major surgery nutrition-related challenges<sup>8</sup>

## Nutrition Intervention following colorectal Surgery:

Patients with any type of bowel surgery should be considered high risk at least until they are eating a full, regular meal plan without difficulties such as cramping, nausea, vomiting, or diarrhea.

## Risk factors to evaluate for determining level of care might include:

- Impaired oral intake preoperatively; nausea, vomiting, or diarrhea.
- Failure to advance oral food plan postoperatively
- Underlying diagnosis, including the following:
  - Inflammatory bowel disease.
  - Gastrointestinal malignancies.
  - Ischemic bowel.
- Fluid and electrolyte imbalance.
- Evidence of malabsorption (We start **Parenteral** first).
- Weight loss.
- Reduced transport proteins indicating underlying inflammation or infection as evidenced by biochemical indices: albumin, prealbumin, retinol-binding protein. **These patients; we start them on proteins until they reach the normal protein level then they go to surgery.**

## Nutritional goals following bowel surgery include:

- Optimize nutritional intake with return to normal intake as soon as possible.
  - Advancing from a clear liquid to a full liquid diet may not be necessary. Full liquid diets are often very high in fat and may not be well tolerated post bowel surgery
  - Modify distribution, type, or amount of food (**small frequent food**) and nutrients within meals or at specified time Formula/ solution (for enteral/ parenteral nutrition).
  - Dietary Modification following colostomy/ileostomy.
- Prevent diet-related and nutrition-related consequences (eg, nausea, vomiting, obstruction, diarrhea, dumping, dehydration).
- Correct any preexisting nutritional deficiencies. **It happens in bowel resection, depending on the site of resection there will be a specific type of deficiency** e.g. resection of the ileum will lead to vit.B12 deficiency.
- Prevent future nutritional deficiencies.

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<sup>8</sup> The most challenging surgeries are colorectal surgery. Bariatric surgery is not that challenging, because majority of the GI is active and intake, they may have some vitamin deficiency that might be corrected by taking supplements



## Nutrition Intervention for ostomy (Colostomy/Ileostomy)

- Provision of short-term or long-term enteral or parenteral feeding.
- Provision of nutrition education for food choices that will facilitate the following:
  - Decrease risk of obstruction
  - Maintain normal fluid and electrolyte balance.
  - Reduce excessive fecal output.
  - Minimize gas and flatulence.
  - Prevent development of oxalate kidney stones.

Surgery	Nutrition Sequelae	Nutrition Management
Partial colon resection	<ul style="list-style-type: none"> <li>● Loose bowel movements</li> </ul>	Initially low-residue nutrition ( <b>low-residual fibers</b> ) therapy with patient self-determining foods not well tolerated; progress to regular diet as tolerated.
Total colectomy	<ul style="list-style-type: none"> <li>● Diarrhea</li> <li>● <b>Dehydration</b> (Because colon is responsible for water absorption).</li> <li>● <b>Electrolyte imbalance</b> (low Na because colon is responsible for Na and fluid absorption).</li> </ul>	Low-residue nutrition therapy, adaptation takes place over time and patient can slowly increase fiber as tolerated, increased fluid and electrolyte intake especially Na.
Rectal with colostomy	<ul style="list-style-type: none"> <li>● Psychosocial issues caused by fear of expelling gas, odor-producing foods.</li> </ul>	Avoidance of potentially gas- and odor-producing foods like <b>beans, onions, garlic</b> .
Small bowel resection	<ul style="list-style-type: none"> <li>● Varies depending on length of small bowel resected, potential malabsorption.</li> </ul>	Determine length and area of bowel resected. If more than 100 cm ileum is resected, increased fluid and electrolyte balance problems; TPN- fluid/electrolyte replacement until patient is able to maintain nutrition orally; slowly increase diet as tolerated to lactose free, complex carbohydrate ( <b>juice or potato</b> ), moderate fat, six small feedings, long-term vitamin (magnesium <sup>9</sup> , B-12) supplementation.

<sup>9</sup> We don't give them Mg food because it is rich with oxalate which will cause kidney stones.



## Immunonutrition:

- In the preoperative phase, formulas enriched with **arginine** (amino acid), omega-3 fatty acids have been shown to improve postoperative immune response, gut oxygenation and enhance recovery.
- Antioxidants, including vitamins C and E, beta carotene, and selenium are often added in an effort to reduce oxidative stress among patients with acute metabolic stress. (wound healing).

## Modified Diet in case of High output ostomy;

- Avoid obstructing food like bean, corn.
- **Limit fluids with meals / 30 min before or after.**
- **Restrict ORAL FLUIDS to 500ml daily** (Meet fluid /electrolyte needs intravenously), low osmolality fluids like milk (patient should avoid high osmolar fluid like tea and coffee).
- Avoid oral Glucose-electrolyte solution instead they should take ORS (oral rehydration solution) like fluid rich with K or Na especially for outpatient.
- Slowing intestinal transit time via loperamide, pectin, and fibers may promote absorption but may cause floating and gases
- Losses of 2 L to 3 L ostomy output per day can also contribute to losses of magnesium, zinc, bicarbonate, potassium, and sodium. If the patient has high output (2-3L or more) we have to look at the intake if it is high then the output is normal, but if the intake is low then it's abnormal.
- The normal output after colostomy is 200-400 ml/day and for ileostomy is 600-800 ml/day, usually immediately after surgery the output is large but it will decrease by time.



# Select the formula

Types	Examples Males doctor said that we are <b>NOT</b> required to memorize these names.	Notes/Indications
<b>Branched-Chain Amino Acid</b> <b>1.5kcal/1ml</b>	<ul style="list-style-type: none"> <li>Nutrihep</li> </ul>	<ul style="list-style-type: none"> <li>Hepatic Encephalopathy:               <ul style="list-style-type: none"> <li>Nutrition support for hepatic disease with elevated ammonia level.</li> </ul> </li> </ul>
<b>Low carbohydrate</b> <b>1.5kcal/ml</b> (For pulmonary patients)	<ul style="list-style-type: none"> <li>Oxepa</li> <li>Pulmocare</li> </ul>	<ul style="list-style-type: none"> <li>Modulate the inflammatory response in:               <ul style="list-style-type: none"> <li>Critically ill, <b>mechanically ventilated patients</b>, especially those with SIRS (systemic inflammatory response syndrome, eg, sepsis, trauma, burns), ALI (acute lung injury) or ARDS (acute respiratory distress syndrome).</li> </ul> </li> </ul>
<b>Nutrient Dense/ Immunonutrients</b> <b>1.2-1.6kcal/ml</b>	<ul style="list-style-type: none"> <li>Impact recovery</li> <li>Forticare</li> </ul>	<ul style="list-style-type: none"> <li>For faster recovery (before and after surgery), Severe trauma/injury, support colonic health, Pressure ulcer/wound.</li> <li>Dietary management of Cachexia in cancer:               <ul style="list-style-type: none"> <li>Pancreatic cancer, lung cancer undergoing chemotherapy</li> </ul> </li> </ul>
<b>Clear Liquids with Protein/ Fat-Free</b> <b>1.5kcal/ml</b>	<ul style="list-style-type: none"> <li>Resource Breeze</li> <li>Fortijuice</li> </ul>	Clear Liquid High Protein, bowel prep, fat malabsorptive/fat restricted, pre or post-surgical, nausea/vomiting/oncology
<b>Standard</b> <b>1 kcal / 1 ml</b>	<ul style="list-style-type: none"> <li>Ensure</li> <li>Nutren 1.0</li> <li>Osmolite RTF</li> <li>Energy zip 1.0</li> <li>Jevity</li> <li>Trophic with fiber</li> </ul>	<ul style="list-style-type: none"> <li>Standard formula can be used via ENTERAL FEEDING OR <b>orally</b>.</li> <li>Can be <u>used for all cases</u>.</li> <li><b>We can give it to anyone who has poor oral intake or is underweight.</b></li> </ul>
<b>Dens-calories</b> <b>1.5g / ml</b>	<ul style="list-style-type: none"> <li>Ensure Plus</li> <li>Fortisip</li> <li>Resource Plus</li> <li>Ensure Two-Cal</li> </ul>	<ul style="list-style-type: none"> <li>For stressed patients and those requiring low-volume feedings.</li> <li><b>For patient who are fluid restricted or can't tolerate 3 bottle/day (hepatic patients).</b></li> </ul>



<p><b>Modified carbohydrate</b> 1 kcal / 1 ml</p>	<ul style="list-style-type: none"> <li>● Glucerna</li> <li>● Resource Diabetic</li> <li>● Diamax</li> </ul>	<ul style="list-style-type: none"> <li>● Used for: <ul style="list-style-type: none"> <li>○ Diabetes Mellitus.</li> <li>○ Hyperglycemia.</li> <li>○ Glucose Intolerance.</li> </ul> </li> <li>● Diabetic formulas usually have more fibers and relatively low carbs.</li> </ul>
<p><b>Low electrolytes</b> 1.5-2 kcal / 1ml (To avoid volume overload)</p>	<ul style="list-style-type: none"> <li>● Novasource Renal</li> <li>● HD Max</li> <li>● It has low Potassium and phosphorus.</li> </ul>	<ul style="list-style-type: none"> <li>● Used for: <ul style="list-style-type: none"> <li>○ Dialysis / Renal Failure / Renal Disease.</li> <li>○ Electrolyte and Fluid restriction</li> </ul> </li> </ul>
<p><b>Semi-Elemental</b> (Partial hydrolytes formula so it is easy to be absorbed (نص مهضومة))</p>	<ul style="list-style-type: none"> <li>● Perative 1.3</li> <li>● Pivot 1.5</li> <li>● Peptamen Complete</li> <li>● Alitraq</li> </ul>	<ul style="list-style-type: none"> <li>● Used for: <ul style="list-style-type: none"> <li>○ Malabsorption syndrome.</li> <li>○ Impaired gastrointestinal function.</li> <li>○ Short bowel syndrome.</li> <li>○ Inflammatory bowel disease.</li> <li>○ Pancreatic insufficiency.</li> <li>○ Chronic diarrhea.</li> <li>○ Radiation enteritis.</li> <li>○ HIV/AIDS-related malabsorption.</li> <li>○ Transition diet from TPN.</li> <li>○ Diarrhea</li> </ul> </li> </ul>
<p><b>Protein</b> 6g per scoop</p>	<ul style="list-style-type: none"> <li>● Beneprotein</li> <li>● Prosource</li> <li>● Patients add it to their food (water, soup).</li> </ul>	<ul style="list-style-type: none"> <li>● Used for: <ul style="list-style-type: none"> <li>○ Protein-calorie malnutrition.</li> <li>○ Wound healing e.g. burns, pressure ulcers.</li> </ul> </li> </ul>
<p><b>Prebiotics</b> These are soluble fibers that will increase water absorption.</p>	<ul style="list-style-type: none"> <li>● Banatrol</li> </ul>	<ul style="list-style-type: none"> <li>● Used for: <ul style="list-style-type: none"> <li>○ Diarrhea and loose stool associated with tube feeding, antibiotics, oncology treatment and Clostridium difficile.</li> </ul> </li> </ul>

**Note:**

- Clear fluid like juice is a very helpful supplement for surgical patient, it will increase their appetite and improve their mental status.



## Recall (EXTRA):

### What is the motto of surgical nutrition?

If the gut works, use it

### What are the normal daily dietary requirements for adults of the following:

- **Protein** = 1 g/kg/day
- **Calories** = 30 kcal/kg/day

### What are the calorie contents of the following substances:

- **Fat** = 9 kcal/g
- **Protein** = 4 kcal/g
- **Carbohydrate** = 4 kcal/g

### What is the formula for converting nitrogen requirement/loss to protein requirement/loss?

Nitrogen X 6.25 = protein

### Where is iron absorbed?

Duodenum (some in proximal jejunum)

### Where is vitamin B12 absorbed?

Terminal ileum

### What are the surgical causes of vitamin B12 deficiency?

Gastrectomy, excision of terminal ileum, blind loop syndrome

### Where are bile salts absorbed?

Terminal ileum

### Where are fat-soluble vitamins absorbed?

Terminal ileum

### What are the signs of the following disorders:

- **Vitamin A deficiency:** Poor wound healing
- **Vitamin B12/folate deficiency:** Megaloblastic anemia
- **Vitamin C deficiency:** Poor wound healing, bleeding gums
- **Vitamin K deficiency:** Decrease in the vitamin K–dependent clotting factors (II, VII, IX, and X); bleeding; elevated PT

### What are the vitamin K–dependent clotting factors?

2, 7, 9, 10 (think: 2+7=9, and then 10)

### What is in TPN?

Protein Carbohydrates Lipids (H<sub>2</sub>O, electrolytes, minerals/vitamins, insulin, H<sub>2</sub> blocker)

### How much of each in TPN:

- **Lipids** = 20% to 30% of calories
- **Protein** = 1.7 g/kg/day (10%–20% of calories) as amino acids
- **Carbohydrates** = 50% to 60% of calories as dextrose

### What are the possible complications of TPN?

Line infection, fatty infiltration of the liver, electrolyte/glucose problems, pneumothorax during placement of central line, loss of gut barrier, acalculous cholecystitis, refeeding syndrome, hyperosmolarity

### What is “refeeding syndrome”?

Decreased serum potassium, magnesium and phosphate after refeeding (via TPN or enterally) a starving patient

### What is the major nutrient of the gut (small bowel)?

Glutamine



# Summary

In the surgical patient, the indications for nutritional therapy are prevention and treatment of catabolism and malnutrition.

## Aims of Nutrition in surgery:

- Prepare / Enhance recovery.
- Prevent malnutrition or diet related consequences
- Define patients who are at risk
- Define special nutrition needs

## Nutrition care vary, in relation to:

- The type of surgery
- The requirement of extensive nutrition support.
- Route of Nutrition
- Postoperative complications

**Malnutrition:** is a broad term that can be used to describe any imbalance in nutrition, from overnutrition to under-nutrition.

## How to detect patients at risk:

Nutritional risk screening in all patients on hospital admission or first contact:

- BMI < 18
- Combined: weight loss and reduced BMI, or a low fat free mass index (FFMI).
- Preoperative serum albumin < 30 g/l

## Laboratory measures:

- **Albumin and prealbumin.**
- Transferrin.
- Nitrogen balance.
- Electrolytes (**Potassium**)
- Total cholesterol.
- Indicators of inflammation

## 'ERAS' Enhanced Recovery After Surgery

- A metabolic strategy to reduce perioperative stress & improve outcome.

## Who needs nutrition support?

- Patient at Nutrition risk/or Malnourished.
- Postoperative complications
- Intractable vomiting
- Maxillofacial and esophageal surgery

## Mode of administration:

- Parenteral (**PN**)
- Enteral (**EN**)

**PN should only be initiated if the duration of therapy is anticipated to be >7 days.**

## Major surgery nutrition-related challenges:

Patients with any type of bowel surgery should be considered at high risk

- **Partial colon resection** - **Total colectomy** - **Rectal with colostomy** - **Small bowel resection**

## Immunonutrition:

- In preoperative phase, arginine & omega-3 fatty acids enriched formulas improve postoperative immune response, gut oxygenation & enhance recovery.
- Antioxidants (vitamins C and E, beta carotene, and selenium) added to reduce oxidative stress.



## Questions

1. Which of following has higher nutritional risk among admitted patients ?
  - A. Medically free patients with serum albumin 27 g/l.
  - B. patients with BMI of 27.
  - C. Patients with BMI of 17.
  - D. Both A & C .
  
2. Which of the following laboratory measures are important in assessing the malnutrition ?
  - A. Serum proteins like albumin and prealbumin.
  - B. Transferrin.
  - C. Electrolytes and Nitrogen balance.
  - D. All of above.
  
3. Which of the following conditions will parenteral nutrition be beneficial for them ?
  - A. Patients with high-output intestinal fistula.
  - B. Patient with ileus.
  - C. Patients after bowel transplant.
  - D. All of above.
  
4. A 28 years old male was brought to the ER after a severe road traffic accident, there were multiple signs of respiratory failure, ER physician suspects that he has acute respiratory distress syndrome. Which of the following is the most appropriate formula in his case ?
  - A. Pulmocare.
  - B. Nutrihep.
  - C. Ensure Plus.
  - D. Beneprotein.
  
5. A 5 year old child was brought to the ER because of severe burns in his abdomen and both lower limbs. Which of the following is the most appropriate formula in his case ?
  - A. Pulmocare.
  - B. Nutrihep.
  - C. Ensure Plus.
  - D. Beneprotein.
  
6. Which of the following conditions need nutritional support ?
  - A. Patients with post-operative sepsis .
  - B. Any admitted patient.
  - C. Patients underwent massive bowel resection.
  - D. Both A & C.

### Answers:

1: D      2: D      3: D      4: A      5: D      6: D