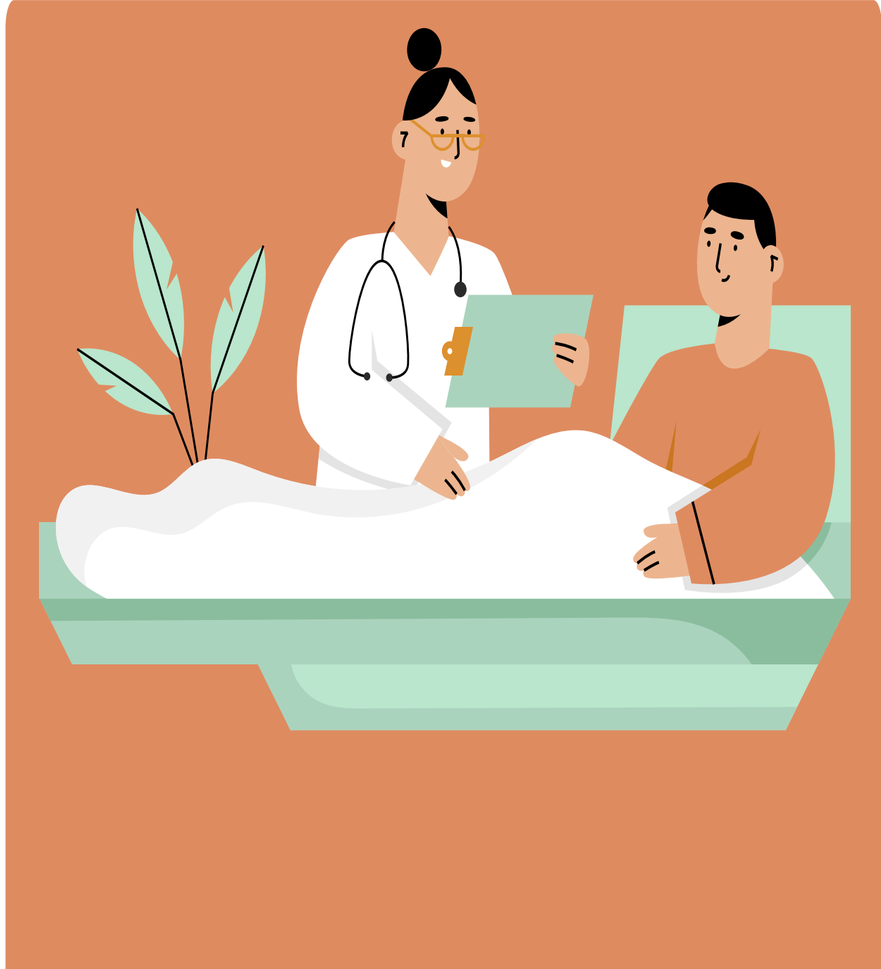
MED437
KING SAUD UNIVERSITY

SURGERY TEAM 437



Nutrition in Surgical Patients

Team leaders: Alanoud Almansour, Ghaida Al Musma , Muath Alhamoud and Omar Alsuhaibani

Done by: Adel Alsuhaibani, Khalid Alshehri, and Shahad Altayash

Revised by: Aseel Badukhon

Color Index:

- Important
- Doctor's Notes
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- Davidson's

Editing File / Feedback

Nutrition

Introduction:

- ➔ Nutritional disorders in surgical practice have two principal components. First, starvation can be initiated by the effects of the disease, by restriction of oral intake, or both.
- ➔ Simple starvation results in progressive loss of the body's energy and protein reserves (i.e., subcutaneous fat and skeletal muscle).
- ➔ Metabolic effects of stress/inflammation; namely, increased catabolism and reduced anabolism. These result in low serum albumin concentration, accelerated muscle wasting and water retention.

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

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 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.

Malnutrition

- ➔ It's the main concern in surgical patients
- ➔ Is a broad term that can be used to describe any imbalance in nutrition; from overnutrition to under-nutrition.
- ➔ Observed up to 40-60% of surgical patient on admission/remains under-diagnose in 70% of patient in hospital settings.
- ➔ Malnutrition seen in hospitalized patients is often a combination of cachexia (disease-related like in cancer patients) and malnutrition (inadequate consumption of nutrients) as opposed to malnutrition alone.

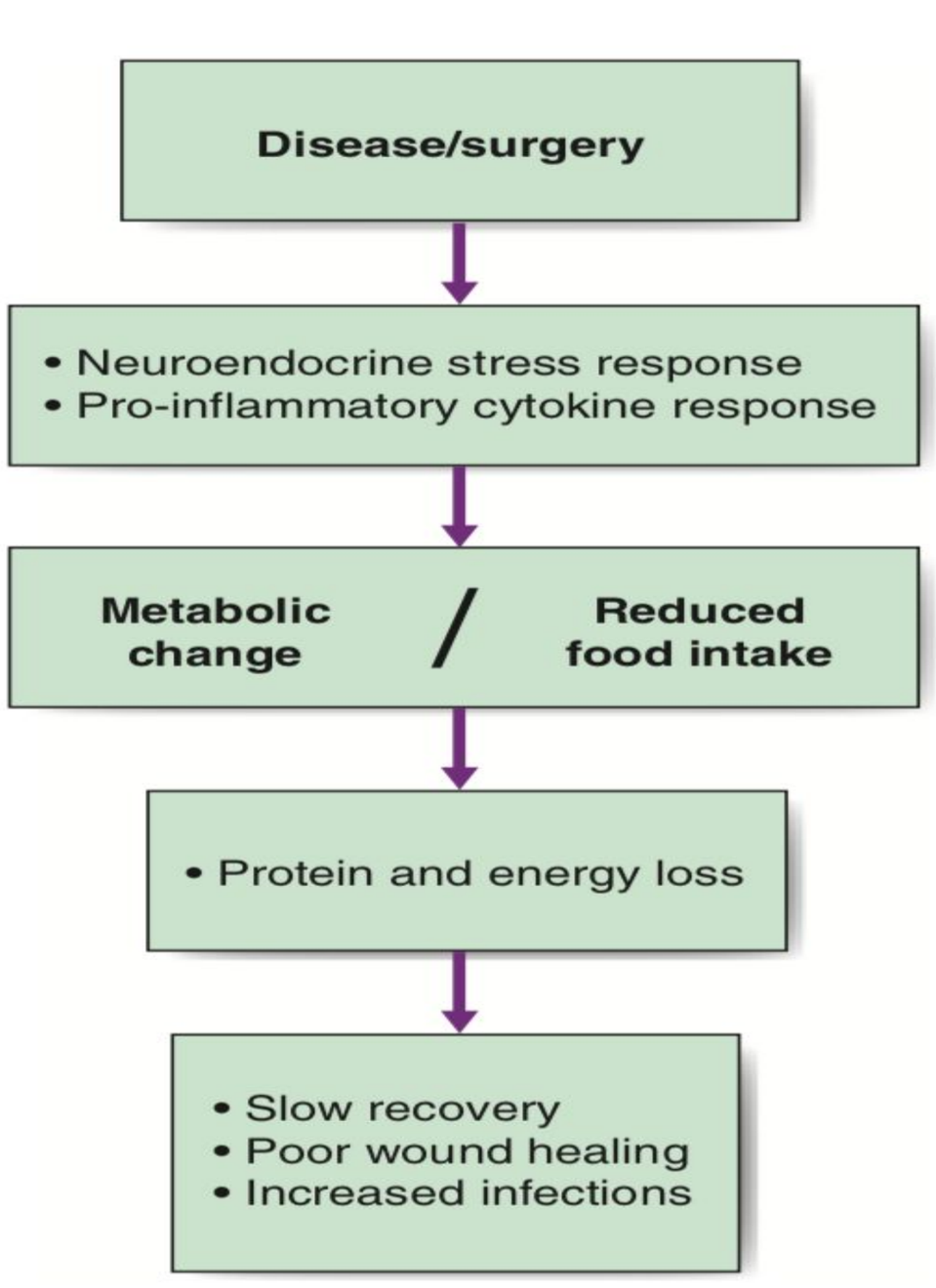
How To Detect Patient At Risk:

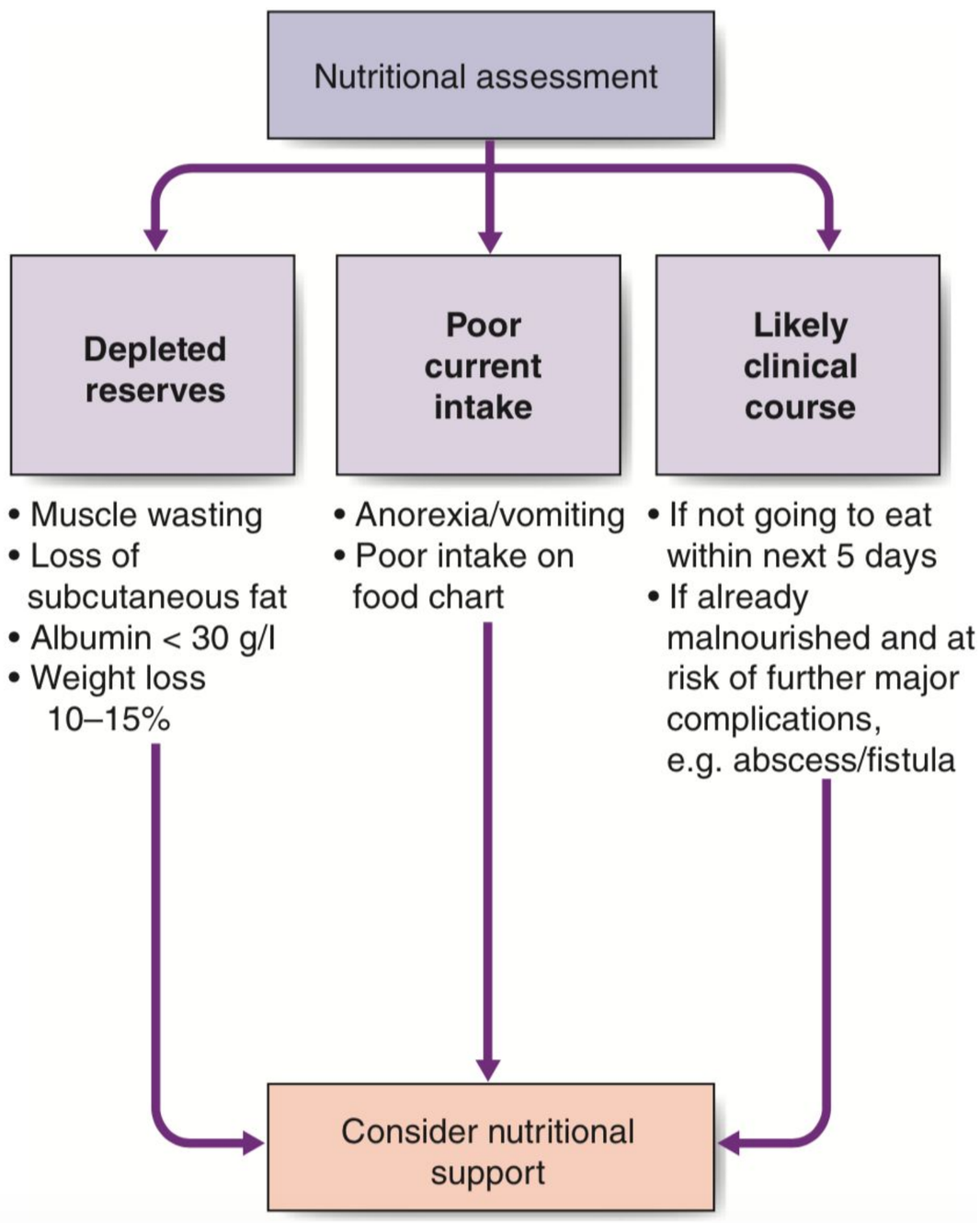
Nutritional risk screening in all patients on hospital admission or first contact:

- ➔ A BMI of less than 18 suggests significant protein-calorie undernutrition. A normal BMI is between 18.5 and 24.9 kg/m^2
- ➔ Combined: weight loss >10% or >5% over 3 months and reduced BMI or a low fat free mass index (FFMI).
- ➔ Preoperative serum albumin < 30 g/l (with no evidence of hepatic or renal dysfunction).

If the patient didn't have enough nutrition during the catabolic state, they will be more prone to have infection, poor healing, and muscle wasting which may present as difficulty swallowing, which may lead to aspiration pneumonia (commonly seen after sleeve).

Malnutrition Adverse Effects	
Impaired wound healing	Impaired immunity & increase risk for infection
Thoracic muscle mass wasting depresses respiratory efficiency & increases the risk of pneumonia	Albumin level decrease leading to generalized edema.
Small bowel mucosa atrophy	Impaired mental function leads to depression
Postoperative complications rate is higher	Prolong recovery time & longer hospital stay





Laboratory Measures

- ➔ Serum proteins such as albumin and prealbumin. Albumin is the most important indicator of nutrition
  - Albumin give an estimation about the nutrition status of the patient during the last 28 days thus if it's low it means that the patient has been malnourished for the last month or even months.
  - Prealbumin will give an up to 3 days estimation
- ➔ Transferrin → up to a week estimation
- ➔ Nitrogen balance → for the patient's protein intake
- ➔ Electrolytes → for fluids intake K (potassium) is the most important electrolyte in nutrition,
- ➔ Total cholesterol → It isn't very helpful if it's elevated due to the patient's underlying disease such as in liver disease but when it's low we do take it into consideration.
- ➔ Indicators of inflammation such as:
- ➔ C-reactive protein (CRP).
- ➔ Total lymphocyte count (TLC).

Enhance Recovery After Surgery (ERAS)

- ➔ Enhanced recovery of patients after surgery ("ERAS") has become an important focus of perioperative management.
- ➔ 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
  - 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

Nutrition Support

Who needs it?

- ➔ Patient at Nutrition risk/or Malnourished Postoperative complications:
  - Ileus more than 4 days
  - Sepsis
  - Fistula formation
  - Massive bowel resection
  - Intractable vomiting;
  - Other conditions:
    - Maxillofacial and esophageal surgery

Preoperative	• Fasting from midnight is unnecessary in most patients → if the surgery isn't GI related • Allow clear fluids until two hours before anaesthesia • Nutritional support prior to major surgery, appropriate period of (7-14) days, for patient with severe nutrition risk → high calories and protein diet to avoid postoperative malnutrition and to help the patient recover faster
Postoperative	• Oral intake, including clear liquids, can be initiated within hours after surgery in most patients. • Early (eternal) tube feeding (within 24 hours) 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, severe trauma including brain injury, patients with obvious malnutrition at the time of surgery, patient on a ventilator.

Select the Formula

This table is from last year's slides but the doctor mentioned a couple of formulas during the lecture (the red ones) thus we advise you to read it. :)

Types	Examples	Notes/ Indications
Branched-Chain Amino Acid **1.5kcal/1ml**	• Nutrihep	• Hepatic Encephalopathy: ○ Nutrition support for hepatic disease with elevated ammonia level
Low carbohydrate **1.5 kcal/ml** **(for pulmonary patients)**	• Oxepa • Pulmocare	• Modulate the inflammatory response in: ○ Critically ill. mechanically ventilated patients, especially those with SIRS (sepsis, trauma & burns) ALI or ARDS
Nutrient Dense/ **Imm□nonutrient** **1.2-1.6kcal/ml**	• Impact recovery • Forticare	• For faster recovery (before and after surgery), severe trauma/ injury, support colonic health, and pressure ulcer. Wound. • Dietary management of Cachexia in cancer: ○ Pancreatic cancer, lung cancer undergoing chemotherapy
Liquids with protein/ **Fat-Free** **1.5 kcal/ ml**	• Resource breeze • Fortijuice	• Clear liquid high protein bowel prep, fat malabsorptive/ fat restricted, pre or post surgical, nausea, vomiting, oncology
Standard **1 kcal/ 1 ml**	• Ensure • Nutren 1.0 • Osmolite RTF • Energy zip 1.0 • Jevity • Trophic w/ fiber	• Standard formula can be used via enteral feeding or orally. • Can be used for all cases ○ Anyone who is underweight or has poor oral intake • Ensure is the most used formula.
Dense-calories **1.5g/ml**	• Ensure Plus • Fortisip • Resource • Ensure Two-Cal	• For stressed patients and those requiring low-volume feedings. • For patient who are fluid restricted or can't tolerate 3 bottles/ day (hepatic patients)
Modified carbohydrate **1 kcal/ 1 ml**	• Glucerna • Resource Diabetic • Diamax	• Diabetes Mellitus • Hyperglycemia • Glucose intolerance • The formulas have more fibers & less carbs
Low electrolytes **1.5-2 kcal/ 1 ml**	• Novasource Renal • HD Max • Nepro	• Dialysis, renal failure, or renal disease • Electrolyte and fluid restriction • Renal patients needs high protein and calorie formula to restrict the fluid intake
Semi-Elemental	• Perative 1.3 • Pivot 1.5 • Peptamen Complete • Alitraq	• Malabsorption syndrome • Impaired GI function • Short bowel syndrome • IBD • Pancreatic insufficiency • Chronic Diarrhea • Radiation enteritis • HIV/AIDS related malabsorption • Transition diet from TPN
Protein **6g per scoop**	• Beneprotein • Prosource	• Protein-calorie malnutrition • Wound healing e.g. burns & pressure ulcers
Prebiotics	• Banatrol	• Diarrhea and loose stool associated with tube feeding, antibiotics, oncology treatment and Clostridium difficile

Modes of Administration

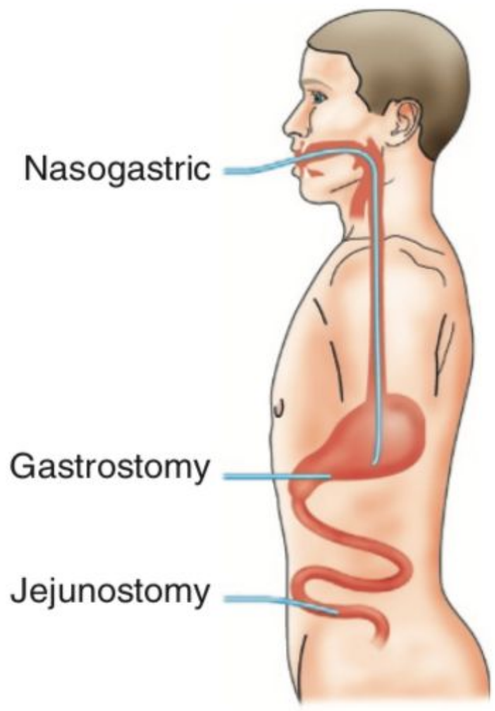
Nutrients can be given via the gastrointestinal tract (enteral nutrition) or intravenously (parenteral nutrition). Parenteral nutrition is indicated only for patients in whom enteral feeding is not feasible.

Enteral Feeding

Indications	Contraindications
• Malnourished patient expected to be unable to eat adequately for > 5-7 days • Adequately nourished patient expected to be unable to eat > 7-9 days e.g. maxillofacial and esophageal surgery • Adaptive phase of short bowel syndrome	• Intestinal obstructions or ileus • Severe shock • Intestinal ischemia • High output fistula • Severe GI bleeding

Methods of administration of enteral feeds:

1. Nasogastric or nasojejunal tubes → for pts who can't drink or sip a liquid feed for mechanical reasons, or if they are unconscious or on a ventilator
2. Gastrostomy → If nasoenteric feeding is impossible or is clearly likely to be required for 6 weeks or more, nutrients may be given through a tube placed into the GIT below the lesion. E.g. in patients with pseudobulbar palsy or an oesophageal fistula or stricture.
3. Jejunostomy → Preferred in cases where the stomach may be required for surgical reconstruction of the proximal lesion. E.g. in patients w/ gastric or duodenal fistula can be fed through a jejunostomy.



Total Parenteral Nutrition (TPN) Not preferred

Indications	Complications
• Intestinal failure • Ileus • Intestinal fistula (high-output) • Abdominal sepsis • Increased metabolic demands, e.g. burns • Initial phase in case of short bowel or after small bowel transplant or during periods of rejection • PN should only be initiated if the duration of therapy is anticipated to be more than 7 days. • In some cases, combined EN/PN showed clinical benefits when compared with EN or PN alone.	• Catheter problems: damage adjacent structures, and can cause pneumothorax, air embolism, and hematoma. • Thrombophlebitis: common when long lines are used, when the catheter tip is not in an area of high flow, and when very hypertonic solutions are infused. superior mediastinal syndrome develops in patients with SVC thrombosis. • Infection: catheter related sepsis and bloodstream infection (CRSBSI) are the most frequent complication of TPN.

Contraindications

- Functional GIT & Colonic ileus
- Awaiting flatus or bowel sounds following surgery
- Patient doesn't want to eat or doesn't want a feeding tube
- Fewer than 7 days of PN therapy

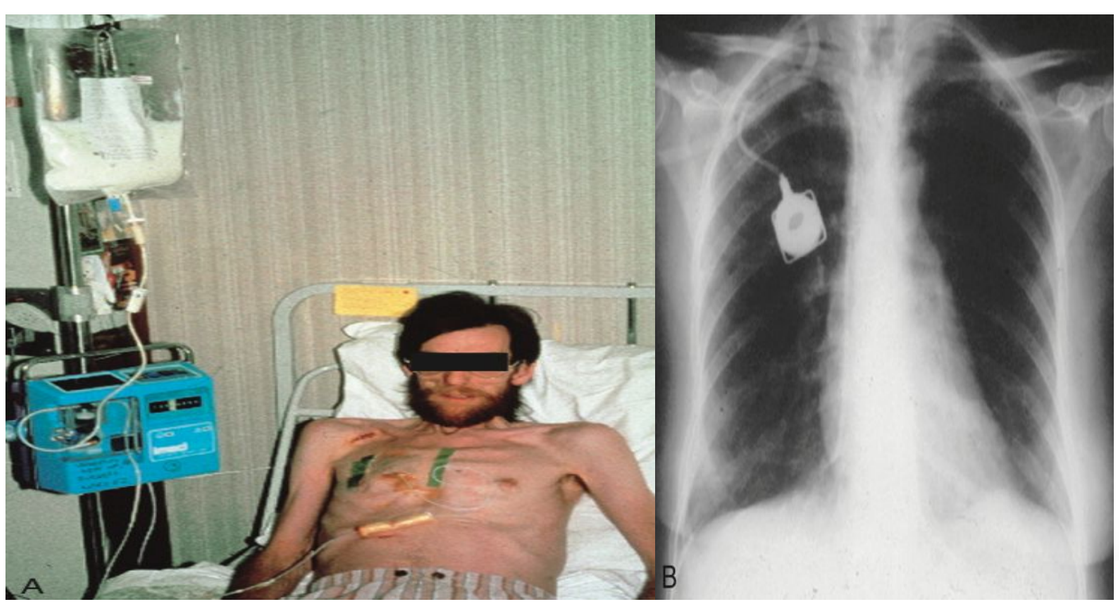


Table 3.5 Detection and treatment of catheter related sepsis

If a pyrexia >38°C develops, or there is a further rise in temperature if already pyrexial • Stop parenteral nutrition and check for other sources of pyrexia (e.g., chest or urinary tract infection) • Take peripheral and central line blood cultures • Administer intravenous fluids • Heparinise catheter • Consult senior medical staff
If blood culture is negative • Restart parenteral nutrition and continue to monitor for signs of sepsis
If blood culture is positive • Remove catheter and send tip for bacteriological analysis • Administer appropriate antibiotic therapy • If necessary, replace catheter and restart parenteral nutrition within 24–48 hours
Where central access must be preserved • Seek specialist advice from hospital nutrition team

Assess Nutrition Needs

Energy And Protein Needs:

BMI (Kg/m^2)	Weight (Kg)	Kcal/ Kg Weight X {A} or {B}	Protein (gm/Kg)
<30	Actual	{A} 20-25 (minor surgery) {B} 25-30 (major surgery)	1 g/Kg/Day (minor surgery) 1.5- 2.0 (major surgery)
30-50 (obese)	Actual Ideal	{A} 11-14 {B} 22-25	1.9-2.0 (IBW)
>50	Ideal	{A} 22-25	2.5 (IBW)

The most important nutritions to give to any patient after surgery are calories and protein. It's very important for protein to be in its appropriate levels unlike fat and carbs, because it helps in the recovery of the patient especially in the process of wound healing.
If the patient is young we will choose the smaller number for the calorie intake
e.g. a 10 year old <30 BMI, minor surgery ⟶ Weight x 20 = kcal/kg

- Ideal body weight for men = 50 + (0.91 x [height in cm - 152.4])
- Ideal body weight for women= 45.5 + (0.91 x [height in cm - 152.4])

Protein Needs for Adults based on Albumin Level and special conditions:

Low albumin means that we have to increase the protein intake

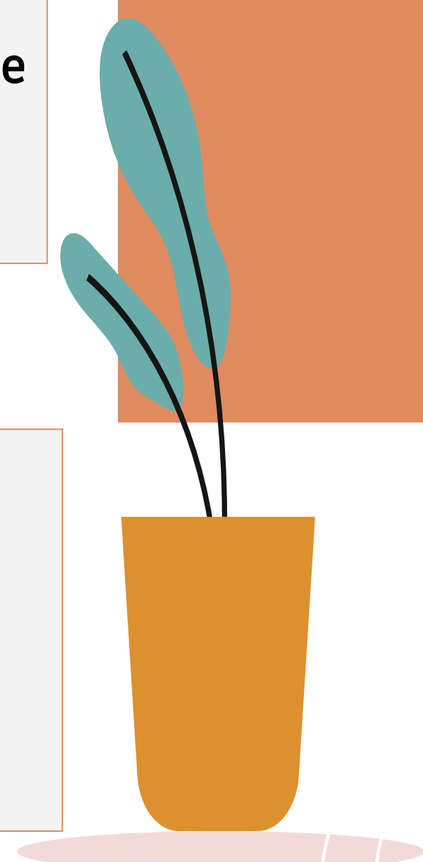
Conditions	Albumin level	Protein requirement
Normal nutrition (healthy adults)	3.5 gm/dL (35 g/L)	0.8 - 1 Gm/Kg/day
Normal nutrition (elderly adults)	>3.5 gm/dL	0.8 - 1 Gm/Kg/day
Mild depletion	2.8 - 3.5 gm/dL	1 - 1.2 Gm/Kg/day
Moderate depletion	2.1 - 2.7 gm/dL	1.2 - 1.5 Gm/Kg/day
Severe depletion	2.1 gm/dL	1.5 - 2 Gm/Kg/day

Fluid Needs:

Age (years)	MI/ 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	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)
40-6- kg	1500-2000 ml	
60-80 kg	2000-2500 ml	
> 80 kg	2500-3000 ml	



Major Surgery Nutrition-related Challenges

Surgery	Nutrition sequelae	Nutrition management
Partial colon resection	Loose bowel movements	Initially low-residue nutrition therapy with patient self-determining foods not well tolerated; progress to regular diet as tolerated
Total colectomy	Diarrhea, dehydration, electrolyte imbalance	Low-residue nutrition therapy; adaptation takes place over time and patient can slowly increase fiber as tolerated, increased fluid and electrolyte intake
Rectal with coloctomy	Psychosocial issues caused by fear of expelling gas, odor-producing foods	Avoidance of potentially gas- and odor-producing foods
Small bowel resection	Varies depending on length of small bowel resected, potential malabsorption	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, moderate fat fat, six small feedings, long-term vitamin (magnesium, B-12) supplementation
Liver resection	Hypoglycemia	Small, frequent, high-protein meals

Colorectal surgery are the most challenging surgeries

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: IBD, GI malignancies & ischemic bowel
- ➔ Fluid & electrolyte imbalance, weight loss & evidence of malabsorption.
- ➔ Reduced transport protein indicating underlying inflammation or infection as evidence by biochemical indices: albumin, prealbumin, retinol-binding protein.

Ostomy (colostomy/Ileostomy):

- ➔ Replace Fluid losses via the ostomy. (200ml-600ml/day, normal output stoma)
- ➔ Post Ostomy, low fiber diet for the first 2 weeks, gradually progress to balance diet (avoid beans, peas, corn)
- ➔ Chew food completely
- ➔ Small frequents meals
- ➔ High protein diet, low simple carbohydrate, high complex carbohydrate & high sodium.
- ➔ Low fat and/or oxalate for the absence of the terminal ileum.

Modified Diet in case of High Output Stoma:

- ➔ Limit fluids with meals/30 min before or after.
- ➔ Restrict oral fluids to 500ml daily (Meet fluid /electrolyte needs intravenously), low osmolality fluids. (give fluids via IV instead to correct electrolytes)
- ➔ Oral Glucose-electrolyte solution/ORS
- ➔ Slowing intestinal transit time via loperamide, pectin, and fibers may promote improved absorption
- ➔ Losses of 2 L to 3 L ostomy output per day can also contribute to losses of magnesium, zinc, bicarbonate, potassium, and sodium.

Immunonutrition:

- ➔ In the preoperative phase, formulas enriched with arginine, 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)

Surgical Recall:

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
What is RQ? Respiratory **Q**uotient; ration of CO2 produced to O2 consumed & the normal RQ = 0.8
What can be done to decrease the RQ? More fat less carbohydrates
What lab tests are used to monitor nutritional status?
Blood levels of
- Prealbumin ($t^{1/2}$= 2-3 days) acute change determination
- Transferrin ($t^{1/2}$= 8-9 days)
- Albumin ($t^{1/2}$= 14-20 days) more chronic determination
- Total lymphocyte count
- Anergy
- Retinol-binding protein ($t^{1/2}$= 12 hours)

What is the best lab to check adequacy of nutritional status? Prealbumin
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 & fat-soluble vitamins are absorbed? Terminal ileum
Which vitamins are fat soluble? K, A, D, E (KADE)
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
- **Chromium deficiency:** Diabetic state
- **Zinc deficiency:** poor wound healing, alopecia, dermatitis, taste disorder
- **Fatty acid deficiency:** dry, flaky skin; alopecia

What vitamin increases the PR absorption of iron? PO vitamin C (ascorbic acid)
What vitamin lessens the deleterious effects of steroids on wound healing? Vitamin A
What are the vitamin K-dependent clotting factors? 2, 7, 9, 10 (think: 2+7=9, and then 10)
What are the common indication for total parenteral nutrition (TPN)?
- NPO > 7 days
- Enterocutaneous fistulas
- Short bowel syndrome
- Prolonged ileus

What is the major nutrient of the gut (small bowel)? Glutamine
What is "refeeding syndrome"?
Decreased serum potassium, magnesium and phosphate after refeeding (via TPN or enteral) a starving patient
What is an elemental tube feed?
Very low residue tube feed in which almost all the tube feed is absorbed
Where is calcium absorbed? Duodenum (actively) & Jejunum (passively)
What is the major nutrient of the colon? Butyrate (and other short-chain fatty acids)
What must bind B12 for absorption? Intrinsic factor from the gastric parietal cells
What sedative medication has caloric value? Propofol delivers 1 kcal/cc in the form of lipid!
Why may all the insulin placed in a TPN bag not get to the patient? Insulin will bind to the IV tubing
How can serum bicarbonate be increased in patients on TPN?
Increase acetate (which is metabolized into bicarbonate)
What are "trophic" tube feeds?
Very low rate of tube feeds (usually 10 to 25 cc/hr), which are thought to keep mucosa alive and healthy

Summary from Davidson

- Nutritional status in surgical patients may be adversely affected by starvation (effects of disease such as oesophageal cancer, restricted intake), the effects of inflammation (increased catabolism) and the effects of the operation itself (stress/inflammatory response)
- Nutritional status is assessed by current food intake, levels of reserves and likely clinical course

Enteral Nutrition

- If patients cannot eat adequate amounts of food they should be reviewed by the dietitian
- If oral supplements fail, a fine-bore tube nasogastric/nasojejunal can be used for supplemental or total enteral nutrition
- Most patients tolerate a whole-protein feed (1 kcal/mL), which can be escalated to 100 ml/hour and thus supply about 2400 kcal/day and 14 g N/day
- If a tube cannot be passed down the oesophagus, gastrostomy and jejunostomy feeding should be considered
- The main complications of enteral feeding relate to patient tolerance (nausea, vomiting and diarrhoea) and to the insertion site (gastrostomy or jejunostomy)

Parenteral Nutrition

- Parenteralfeedingisindicatedifthepatientcannotbefedadequatelyby the oral or enteral route
- The need to restrict volume when using total parenteral nutrition (TPN) means that concentrated solutions are used, which may be an irritant and thrombogenic. TPN is therefore infused through a catheter in a high-flow vein (e.g., superior vena cava)
- TPN is usually given in an 'all-in-one' bag with a mixture of glucose, fat and L-amino acids combined with fluid, electrolytes, vitamins, minerals and trace elements
- The major complications with TPN can be classed as catheter- related, septic or metabolic. A multidisciplinary approach to the management of TPN patients by a nutrition team will minimise such complications

Table 3.4 Standard parenteral nutrition regimen

Constituent	Quantity
Nonprotein energy	2200 kcal
Nitrogen	13.5 g
Volume	2500 mL
Sodium	115 mmol
Potassium	65 mmol
Calcium	10 mmol
Magnesium	9.5 mmol
Phosphate	20 mmol
Zinc	0.1 mmol
Chloride	113.3 mmol
Acetate	135 mmol
(Adequate vitamins and trace elements)	

Quiz

1) After a multidisciplinary review, a 55-year-old patient is commenced on enteral feeding. After 24 hours, he complains of severe diarrhoea. What is the most appropriate step in managing this patient?
    A. Speed up enteral feed
    B. Stop the enteral feed
    C. Slow down the enteral feed
    D. Continue the enteral feeding at current rate and exclude other causes

2) What is the best lab to check adequacy of nutritional status?
    A. Prealbumin
    B. Transferrin
    C. Electrolytes
    D. None of the above

3) A 75-year-old Caucasian man is on the intensive care unit following an emergency Hartmann's procedure for an obstructing sigmoid carcinoma. He is currently 6 days post-procedure. His past history includes chronic obstructive pulmonary disease. The nursing staff report high nasogastric aspirates despite slow enteral feeding at 10 mL/hour. On examination his abdomen is mildly distended, and generally tender with no peritonism. His stoma looks healthy but has not started to work yet. His bowel sounds are absent. What is the best way to manage this patient's nutrition?
    A. Continue nasogastric feeding
    B. Site nasojejunal tube and start feeding
    C. Commence total parenteral nutrition
    D. Site a percutaneous gastrostomy tube
    E. None of the above

4) You are called to see a 50-year-old Asian man who has been receiving total parenteral nutrition for 6 days via his central line. He is 15 days following subtotal colectomy and ileostomy. The nursing staff are concerned as he appeared to have a rigor. He is febrile at 38.0 °C. His pulse rate is 100 beats/min, and his blood pressure is 130/70 mmHg. His lung bases sound quiet and his notes document that a urinary catheter was removed day 6 postoperatively. His abdomen is mildly tender with no signs of peritonism. Which of the following is the most likely source of sepsis?
    A. Peritoneal collection
    B. Central line sepsis
    C. Respiratory tract infection
    D. Urinary sepsis
    E. Contaminated total parenteral nutrition

1: C
2: A
3: C
4: B