

Nutrition in the surgical patient

Nutrition plays a vital role in wound healing and collagen maturation, and it boosts the energy reserves of the body. The combination of infection and injury (surgery or trauma) particularly predisposes to malnutrition. These additional stresses inhibit the ketotic response to starvation and encourage the preferential mobilization of muscle protein. The immune response to infection also becomes downregulated and T cell, B cell and macrophage function deteriorates.

Nutritional requirements

These include carbohydrate, fat, protein, vitamins, minerals and trace elements.

Energy is provided by carbohydrate and fat

A healthy adult at rest requires 6300—8400 nonprotein kilojoules per day for energy (1500—2000 calories). Carbohydrate provides 16.8 kJ/g (4.1 kcal/g) and fat 37.8 kJ/g (9.1 kcal/g). The number of nonprotein kilojoules given should bear a definite relationship to the nitrogen intake. A typical regime would feature 8400 kJ (2000 kcal) to 13 g N (about 150 to 1).

Nitrogen requirements

The minimum for dynamic tissue turnover, and so to keep a healthy adult in positive nitrogen balance, is about 35—40 g of protein or 5.5—6.5 g of nitrogen per day. The hypercatabolic patient requiring hyperalimentation may need three or four times this amount of protein. A daily negative nitrogen balance of 10 g is not unusual and is equivalent to a loss of 62.5 g of protein or 300 g of muscle tissue.

Vitamins

Whatever the method of feeding, vitamins are necessary as supplements, as they are essential for the maintenance of normal metabolic function.

The water-soluble vitamins B and C act as coenzymes in collagen formation and wound healing. Postoperatively, the vitamin C requirement increases to 60—80 mg/day. Preoperative depletion is exacerbated by anorexia, smoking, aspirin and barbiturate therapy. Vitamin B12 is given 500 micro gram intramuscularly (i.m.) weekly, particularly to those with initial low levels (coeliac disease, Crohn's disease, ileal resection or bypass, blind-loop syndrome, tapeworm infestation, reduced pancreatic secretion, tropical sprue, excess alcohol intake, anticonvulsant therapy and after gastric surgery). As the serum folate falls, especially in those on parenteral nutrition, folic acid is required daily in doses of 3—6 mg i.m.

The fat-soluble vitamins A, D, F and K are reduced in steatorrhoea and the absence of bile. Vitamin A, 5000 units per week, is required after surgery and, when appropriate, it enhances the antitumour effect of cyclophosphamide. Vitamin K 5—10 mg i.m. weekly reduces any bleeding tendency. If commercially available vitamin additives are put into an infusion, the container should be protected from the light.

Minerals and trace elements

Sodium, potassium, iron, calcium and magnesium deficiencies must be identified and made good. Zinc deficiency is manifest as a rash on the face and perineum which does not respond to antifungal therapy, stomatitis which causes disturbance of taste (dysgeusia) and alopecia.

Copper deficiency results in leucopenia and anaemia, while lack of chromium may give rise to glucose intolerance. The 14 trace elements that are considered essential for normal enzyme activities include manganese, cobalt, molybdenum and vanadium. It is to be remembered that long-term parenteral nutrition can result in depletion.

A typical regimen for providing enteral or parenteral nutritional support in surgical patients

Fluid/water requirements	25–35 ml/kg/24 h
Protein/nitrogen requirements	0.15–0.20 g nitrogen/kg/24 h
(1g nitrogen=6.25 g protein)	10–14 g nitrogen/24 h
Energy requirements	25–40 kcal/kg/24 h (rarely >35 kcal/kg/24 h)
Carbohydrate (4 kcal/g) Fat (9 kcal/g)	Usually mixed source with both carbohydrate and fat
Minerals	
Calcium	0.11 mmol/kg
Magnesium	1 mmol/kg
Phosphate	2 mmol/kg
Zinc	0.3 μmol/kg

Methods of assessment of nutritional status

The following parameters are included.

- 1. Body weight.** Careful weighing on a bed weighing machine is the obvious way of detecting the progress of the patient. The desirable weight of the patient can be checked by reference to the appropriate tables, or by applying the body mass index (BMI) = weight (kg)/height² (in). A woman should have an index of 20, 21 or 23, and a man 20.5, 22 or 23.5 according to size of frame (small, medium or large).
- 2. Upper arm circumference.** Feeding is indicated if the circumference is less than 23 cm in females and 25 cm in males.
- 3. Triceps skin fold thickness.** Using a skin fold calliper, the minimum is 13 mm in females and 10 mm in males.
- 4. Serum albumin** should not be less than 35 g/litre.
- 5. Lymphocyte count.** Less than 1500/cubic mm indicates an impaired cellular defence mechanism.
- 6. Candida skin test.** A negative reaction also means defective cell-mediated immunity.
- 7. Nitrogen balance studies.** The total nitrogen intake is compared with the loss from all sources, such as urine, fistula drainage and nasogastric aspirate (1 litre = 1 g nitrogen). A greater loss than intake indicates a negative balance and tissue breakdown. A positive balance means anabolism—tissue synthesis.

Other measurements include those determining the rate of muscle breakdown, such as urinary creatinine excretion, or 3-methylhistidine excretion. Body potassium and nitrogen are used to assess the absolute size of the body cell mass. Leucine incorporation is a measure of the synthesis rate, while serum transferrin is used as a measure of visceral protein synthesis (needs to be more than 1.5 g/litre).

Nutritional support

There is evidence of reduction in postoperative complications and length of hospital stay if supplemental sip feeding is started as soon as the patient can take fluid postoperatively.

The indications for nutritional support include:

- Protracted post-operative recovery. For example, sepsis.
- Intestinal failure. For example, peritonitis or enterocutaneous fistulae.
- Profound requirements. For example, large burns, major trauma.
- Pre-operative malnutrition. For example, geriatric patients from homes, carcinoma of the oesophagus.
- Unconscious patient. Head-injured patients, ventilated patients in the ICU.

Some clinical indications for nutritional support are:

- Preoperative nutritional depletion;
- Postoperative complications:
 - Ileus more than 4 days,
 - Sepsis,
 - Fistula formation;
- Intestinal fistula;
- Massive bowel resection;
- Management of:
 - Pancreatitis,
 - Malabsorption syndromes,
 - Ulcerative colitis,
 - Radiation enteritis,
 - Pyloric stenosis;
- Anorexia nervosa;
- Intractable vomiting;
- Maxillofacial trauma;
- Traumatic coma;
- Multiple traumas;
- Burns;
- Malignant disease;
- Renal failure;
- Liver disease;
- Cardiac valve disease.

Consequences of surgery

Abdominal operations result in a degree of gut dysfunction, the extent of which depends upon the severity of the disease pathology and on the type and trauma of the surgery. The sequence of intestinal recovery after a laparotomy is often predictable, small bowel recovering first followed by the stomach and then the colon. If enteral nutrition is withheld, functional gut mass reduces, the enterocytes decline in number and the villi flatten. The mucosal barrier then weakens which encourages bacterial translocation into the portal circulation. Endotoxins can be released from these Gram-negative bacteria and lead to endotoxic shock and circulatory failure.

The effects of malnutrition

Include:-

- 1) poor wound healing manifesting as wound dehiscence and leaking anastomoses of bowel, delayed callus formation,
- 2) Disordered coagulation,
- 3) Reduced enzyme synthesis,
- 4) Impaired oxidative metabolism of drugs by the liver,
- 5) Immunological depression with increasing susceptibility to infection,
- 6) Decreased tolerance to radiotherapy and cytotoxic chemotherapy,
- 7) Severe mental apathy and physical exhaustion of the patient.

Enteral versus parenteral

The preferred nutritional route is oral or enteral rather than parenteral. Food has a trophic effect on the intestine which is well known for example in the context of the compensatory hyperplasia which occurs in response to intestinal resection and may be mediated by dietary fat. Villous atrophy occurs despite parenteral feeding, perhaps because luminal stimulation is required or because parenteral feeds have lacked glutamine, an important gut fuel.

Methods of giving enteral nutrition

- 1) Percutaneous endoscopic gastrostomy (PEG)
- 2) Feeding jejunostomy

Total parenteral nutrition (TPN)

Any patient who is in need for nutritional support and cannot take it enterally should receive it paraterally

The rout of giving the paranteral feeding is a large central vein and is commonly preferred through the subclavian vein

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