

Vitamin	Function	Dose
Vitamin A	Cell growth, night vision	10 000–25 000 IU
Vitamin D	Calcium metabolism	400–1000 IU
Vitamin E	Membrane antioxidant	400–1000 IU
β-carotene*	Antioxidant	50 mg
Vitamin K	Activation of clotting factors	1.5 mcg/kg per d
Thiamine (vitamin B <sub>1</sub> )	Oxidative decarboxylation	10 mg
Riboflavin (vitamin B <sub>2</sub> )	Oxidative phosphorylation	10 mg
Niacin (vitamin B <sub>3</sub> )	Part of NAD, redox reactions	200 mg
Pantothenic acid	Part of coenzyme A	100 mg
Biotin	Carboxylase activity	5 mg
Pyridoxine (vitamin B <sub>6</sub> )	Decarboxylase activity	20 mg
Folic acid	Haematopoiesis	2 mg
Vitamin B <sub>12</sub>	Haematopoiesis	20 mcg
Vitamin C	Antioxidant, collagen synthesis	2000 mg

### vitamin requirements

### indications for parenteral nutrition

General:

- (i) feeding into GI tract is contraindicated
- (ii) enteral feeding fails to meet nutritional requirements
- (iii) enteral access is unobtainable

Pre-operative PN:

- in mild or moderate malnutrition parenteral nutrition is not normally indicated. It is indicated if the operation is to be delayed for more than 3-5 days and enteral access is not possible
- in severe malnutrition, preoperative PN is indicated within 1-3 days of admission if immediate surgery is not possible and a substantial period of preoperative starvation is likely

Post-operative PN:

- indicated in mild to moderate malnutrition where oral or enteral feeding is not possible within 7 days. It should be considered in severe malnutrition after 5 days.

Nursing	Temperature
	Pulse
	Blood pressure
	Respiratory rate
	Fluid balance
	Blood sugar (4-hourly, when commencing feed)
Daily (at least)	Review of fluid balance
	Review of nutrient intake
	Blood sugar
	Urea, electrolytes and creatinine
Weekly (at least)	Full blood picture
	Coagulation screen
	Liver function tests
	Magnesium, calcium and phosphate
	Weight
As indicated	Zinc
	Uric acid

### minimum monitoring requirements on TPN

TPN

### complications of TPN

### trace element requirements

Element	Function	Dose
Selenium	Anti-oxidant, fat metabolism	100 mg
Zinc	Energy metabolism, protein synthesis, epithelial growth	50 mg
Copper	Collagen cross-linking, ceruloplasmin	2–3 mg
Manganese	Neural function, fatty acid synthesis	25–50 mg
Chromium	Insulin activity	200 mg
Cobalt	B <sub>12</sub> synthesis	
Iodine	Thyroid hormones	
Iron	Haematopoiesis, oxidative phosphorylation	10 mg
Molybdenum	Purine and pyridine metabolism	0.2–0.5 mg

#### 1. catheter-related sepsis

- femoral route for administration of TPN is associated with a significantly greater incidence of bacteraemia than arm, neck or subclavian sites

#### 2. catheter occlusion:

- central venous catheters may be partially or totally occluded by clot, calcium, or lipid deposits

#### 3. disorders of glucose control:

- hyperglycaemia is the most common metabolic abnormality during TPN & supplemental insulin is often required
- excessive glucose administration has also been shown to induce positive sodium & water balance, increase catecholamines & induce hypophosphataemia which causes paraesthesia, muscular weakness, confusion, convulsions & coma
- rebound hypoglycaemia may occur if glucose is suddenly stopped

#### 4. hypercholesterolaemia:

- the most common alteration of serum lipids; may develop rapidly & cause cloudy serum
- may be prevented by the use of fat emulsions with low phospholipid to triglyceride ratio
- may be treated by stopping fat administration, infusing heparin to increase plasma lipolytic activity & infusing glucose with insulin to increase lipase activity in adipose tissue

#### 5. refeeding syndrome:

- used to describe various metabolic abnormalities that can arise as a result of refeeding malnourished patients
- due to massive cellular uptake of phosphate, potassium & magnesium caused by insulin secretion in response to a glucose load
- may cause a range of life threatening clinical manifestations such as arrhythmias, heart failure, respiratory failure, confusion, lethargy, cranial nerve palsy, seizures, haemolysis, fatty liver etc

#### 5. abnormalities of liver function:

- aetiologically obscure and probably multifactorial
- patients on long-term TPN may show persistent elevations of liver enzymes, steatosis & cholecystitis with or without calculi
- use of cyclic infusions and provision of 30–40% of non-protein calories as fat may minimise the development of this complication

#### 6. other problems:

- low bone mass (aetiology unknown)
- decreased GFR (aetiology unknown)