Parenteral Nutrition Support

- Provision of required nutrients though intravenous route
- Portal parenteral nutrition
  - May be given as supplementation to oral feeding
  - A supplementation to enteral feeding
- Enteral feeding shound normally be preferred to keep GI tract functional and avoid GI tract atrophy
- Total Parenteral nutrition
  - All nutrient requirements are supplied through I/V route

Necessity for Nutritional Intervention

- PEM adversely affects patient outcome in medical & surgical population especially patients requiring critical care
- Two independent surveys criticized the medical system for neglecting the basic nutritional needs of hospitalized patients. The surveys found that upto 50% of medical & surgical patients had evidence of protein- energy malnutrition (PEM). (12,186)
- The neglect for treatment of malnutrition was primarily due to lack of nutrition education offered in medical schools & more focus on new pharmaceutical & metabolic monitoring technologies
- AAMC disclosed in 1994 that only 22% of Medical Schools had required nutrition course included in curriculum.

* Bristrian BR, Blackburn GL, Vitale J, etal: Prevalence of melnutrition in general medical patients. JAMA 235, 1567-1570, 1976.

* Weinsier RL, Hunker EM. A prospective evaluation of general medical patients during the course of hospitalization. Am.J.Clin.Nutr;32:418-426, 1979.

Necessity for Nutritional Intervention (cont)

- A large no of studies documented that hypoalbuminemia, weight loss & other indices of PEM are undoubtedly associated with:
- Increased incidence of infection & mortality
- Increased length of hospitalization and increase in medical care cost
- One study found a pre-operative weight loss of 4.5 kg to be associated with a 19 fold increase in postoperative mortality*
- Reilly & coworkers (1988) reviewed the medical & surgical patients record and found that patients with at least 1 positive indicator of malnutrition had a 3.8 fold increased risk of death, a longer mean length of hospitalization and an increased excess cost of $ 1738 per patient.

Necessity for Nutritional Intervention (cont)

- Properly designed studies have shown that preoperative TPN:
  - Decreased complications in severely malnourished patients
  - Reduced major complications & mortality in patients with GI carcinoma
  - Reduced the need for ventilatory support & intensive care unit length of stay in post transplantation patients

Nutrition Care Standards

- 1995 Joint commission on accreditation of healthcare organizations (JCAHO) formulated specific nutrition care standards
- Nutrition risk screening on patient admission
- Subsequent nutrition assessment as appropriate
- Monitoring the affectiveness of planned nutrition interventions

Clinical Nutritional Assessment

Objectives

- Identify patients who will benefit from nutrition intervention
- To determine baseline values to compeer effectiveness of nutrition therapies
- Detect & treat macronutrient and micro-nutrient deficiencies

Nutritional Assessment (cont)

- Comprehensive nutrition assessment by registered dietitian
- History
  - Information on weight change
  - Dietary habits
  - Appetite
  - GI function
  - Use of vitamins / mineral supplements
  - Use of drugs

Nutritional Assessment (cont)

- Physical Exam
  - Overt symptoms / signs of nutrition deficiency
  - Metabolic demand of Pts underlying disease. Burns sepsis etc
  - General appearance of poor health & subcutaneous fat & muscle wasting, cachexia, oedema, body mass index (BMI < 20 kg /m^2 evidence of malnutrition)
  - % body weight loss = UBW – CBW / UBWx100

Laboratory Assessment of Nutrition

- Vital role for assessment of nutritional status (because of marked changes in body composition that occur in malnutrition)
- Lean body mass (LBM) / body cell mass (BCM) measurement. An essential assessment.
- A large variety of Radioisotopic, Radiological and laboratory tests available
- Practically 24 h urinary creatinine, regional computed tomography and total body water (TBW) measurement by $^{3}H_2O$ dilution are most sensitive measures for detecting changes in muscle mass / LBM

Biochemical Measurements

Urinary creatinine & creatinine / height index (CHI)

- 24 h urinary creatinine excretion correlate with total body mass (with normal renal function, food intake & diet of constant composition. Creatinine excretion declines with age & ↑ by acute infection, injury, stress, rigorous exercise & diet high in protein).
- The CHI correlates 24 h creatinine excretion in a patient to published values for a normal healthy control of same age sex & height

$$\text{CHI} = \frac{\text{mg creatinine / 24 h (patient)}}{\text{mg creatinine / 24 h (control)}} \times 100$$

- A decrease in muscle mass reflected in a proportionate decrease in CHI
  - 80-90% index value = mild muscle mass depletion
  - 70-80% CHI value = Moderate depletion
  - <70% severe depletion

Biochemical Measurements (cont)

Plasma Proteins

- During short periods of inadequate dietary intake-Decrease in plasma protein levels.
- In chronic starvation the level of Plasma protein may be normal due to decreased catabolism & reduction in blood volume
- Other factors altering protein conc. Physiological & pathological consumption, hydration status, patient posture at the time of specimen collection, liver & renal function status.

Plasma Proteins Alterations

- Change in each plasma protein conc. exhibits a characteristic time course after injury:
  - Albumin – level decreases after about 5th days
  - Prealbumin (Transthyretin) & RBP fall more rapidly 2-3 day. These are more useful marker for adequacy of nutritional intervention as they return to normal level
  - Transferrin – level falls in 2 days*
  - CRP reaches a peak after 48 hrs
  - $\acute{\alpha}_1$ – acid glycoprotein reaches a peak between 2-4 days

Plasma Proteins

- **Practical Approach:** To calculate prognostic inflammatory & nutritional index (PINI)

$$\frac{\text{CRP (mg/L)} \times \alpha_1\text{- acid glycoprotein (mg/L)}}{\text{Albumin (g/L)} \times \text{prealbumin (mg/L)}}$$

- Non infected, well nourished individual value <1
- Low, medium & high risk patients have values 1-10, 11-20 and 20-30

Biochemical Measurement (cont)

- Liver function tests
- Renal function tests
- Electrolytes
- Ca, PO4, Mg, Iron, TIBC
- Plasma Glucose
- Trace elements*
- Vitamins**

Indications for PN

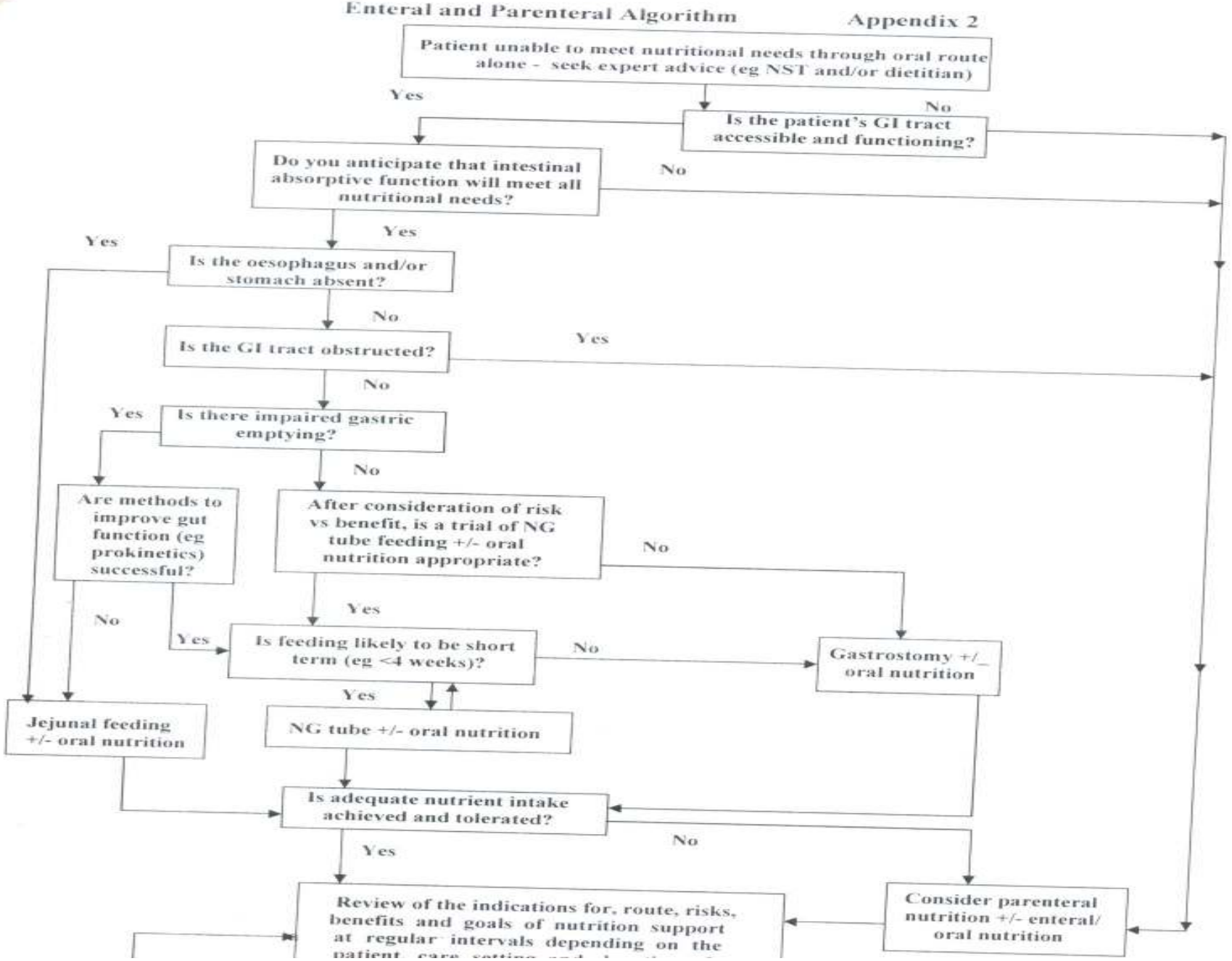
- **GIT Disorders**
  - Oesophageal trauma, strictures
  - Gastrointestinal stenoses / obstruction
  - Operations on GI tract
  - Bowel fistulal
  - Inflammatory bowel disease (crohn's disease)
  - Radiation entercitis
  - Short bowel
  - Prolonged paralytic ileus
  - Intractable diarrhoea
  - Pancrectitis
  - Peritonitis

Indications for PN (cont)

- Renal failure
- Hepatic failure & liver transplantation
- Bone marrow transplantation
- Head injury & neurosurgery, strokes
- **Severe burns**
- SIRS & Sepsis
- Neonatology (Prematurity)
- Severe malnutrition
- **Anorexia**
- **Cancer**

Enteral and Parenteral Algorithm

Appendix 2



Parenteral Nutrition PN

- Provision of all nutrients via the I/V route
- It bypasses GI digestion & absorption
- Predigested energy & proteins sources as well as essential fatty acids, vitamins and minerals are directly delivered into venous system

The Nutrition Support Team

- Representatives from nursing, dietitian, pharmacy, medicine, surgery & laboratory.

PN Venous Access

CPN when parenteral nutrition directly delivered into superior vena cava via a catheter – necessary when sol of 1500-1800 mosmol/l are infused at a rate of 2-3 ml/min & are diluted 1000 fold by flow of blood

PN Venous Access

- PPN (Peripheral Parenteral Nutrition) has fewer complications & more safe. PPN should be considered in the majority of cases where PN is indicated for 7-10 days.

- Osmolality should be < 1100 mosmol/l.

- It means that only regimens covering basal requirements can be infused peripherally.

Clinical Monitoring of Hospitalized Adult Patients on Parenteral Nutrition

Parameter	Unstable patient	Stable patient
Patient examination	Once per day	Once per day
Temperature	Every 4 hours	Once per day
Pulse, blood pressure	Every 4 hours	Once per day
Respiration	Every 4 hours	Once per day
Ward urine analysis	Every 6 hours	Once per day
Fluid balance	Once per day	Once per day
Nutrient intake	Once per day	Once per day
Body weight	Once per day	Once per day

Laboratory Monitoring of Hospitalized Adult Patients on Parenteral Nutrition

Parameter	Unstable patient	Stable patient
In blood:		
Haemoglobin	Once per day	Twice per week
Cell Counts	Once per day	Twice per week
Prothrombin Time	Once per day	Twice per week
Glucose	Every 6 hours	Once per day
Acid Base Balance	Once per day	Not required

Laboratory Monitoring of Hospitalized Adult Patients on Parenteral Nutrition

Parameter	Unstable patient	Stable patient
In serum:		
Electrolytes	Once per day	Twice per week
Ionized Ca & PO_4	8 hours afterward	Twice per week
	Once per day	
Magnesium	Once per day	Twice per week
Urea, Creatinine	Once per day	Once per day
Albumin	3 times per week	Twice per week
Triglycerides	6 hours, afterward daily	Thrice per week
AST, ALT, Bil	Three times per week	Twice per week
Osmolality	Once per day	Twice per week

Laboratory Monitoring of Hospitalized Adult Patients on Parenteral Nutrition

Parameter	Unstable patient	Stable patient
In urine:		
Glucose	Once per day	Once per day
Na, K, Cl	Once per day	Once per day
Urea, Creatinine	Once per day	Once per day
Osmolality	Once per day	Twice per week

Complications of PTN

Cather / Cannula Related

- Infection
- Malposition
- Perforations of vessels
- Pneumothorax, Hydro/haemothorax
- Septic complications

Metabolic Complications

- Dehydration / over hydration
- Alkalosis / acidosis
- Hypocalcemia / hypercalcemia
- Hypophosphatemia
- Hyperglycaemia
- Hyperosmolar coma
- Essential fatty acid deficiency

Refeeding syndrome

Case Study

A 61 year old female a teacher by profession noticed sharp pains and feeling of fullness in her stomach for the last 6 months. Thinking it was ulcers, she tried to ignore the discomfort. However, for the last 3 weeks pain has become severe enough that she has not been able to work. Her appetite has diminished and she noticed she is losing weight. She consulted the doctor.

On examination it was found that she lost 7 kg weight. The radiological investigations revealed a tumor in a stomach. She was admitted to hospital. Biopsy revealed the tumor was malignant with metastasis. She remained in the hospital while chemotherapy and radiation therapy were begun. Her doctor asked RD to formulate TPN recommendations and meanwhile administered D_5 NS at 50 ml/h.

Case Study (cont)

Objective Data

Gender: Female

Age: 61 year

Height: 5’ 3”

Weight: 53 kg

UBW: 60 kg

Labs

Hct	34 %	(33 – 44)
PCV	65 f/l	(85 – 95)
Hb	9.5 g/dl	(11.5 – 15.5)
Glucose	4.8 mmol/l	(3.5 – 6.1)
Urea	4.0 mmol/l	(3.0 – 6.7)
Alb	29 g/l	(35 – 50)
Sodium	145 mmol/l	(135 – 145)
Potassium	3.3 mmol/l	(3.5 – 5.0)
ALT	21 U/l	(<37)

Case Study (cont)

Q: Why did the doctor order TPN rather than tube feeding?

Ans: GI dysfunction due to tumor and cancer.
GI dysfunction due to chemotherapy & radiation therapy
Increased calorie and protein needs due to cancer, surgery and cancer treatment, anorexia due to cancer.
Patient already malnourished as indicated by weight loss and lab tests.

Case Study (cont)

Q: Why CPN was preferable to PPN ?

Ans: She has high nutritional needs because she is malnourished and has severe stress factors (surgery as well as chemotherapy & radiation therapy)

She might need to be on TPN for extended period of time.

Case Study (cont)

Q: Which of the abnormal lab values are indicative of malnutrition?

Ans: Haemoglobin

Haematocrit

MCV

Albumin level

Case Study (cont)

Q: Should iron be added to TPN as she has low Hb and MCV?

Ans: Before any iron is given she transferrin levels should be checked.

If levels are low free iron will rise and can increase the susceptibility to infections.