Nutrition Support in Surgical Patients

" thy food shall be thy remedy"
Hippocrates c. 400 B.C.

Dr Ong Hock Soo
Department of Upper GI & Bariatric Surgery
Singapore General Hospital

Objectives

1. Malnutrition: effects and definition
2. Steps in providing nutritional support: Enteral and Parenteral nutrition
3. Role of perioperative nutritional support
4. Immunonutrition

Malnutrition

- 10 - 40% of hospitalised patients are malnourished
- Surgical diseases predispose to malnutrition
- Post-operative recovery period
- Post-operative complications
- Malnutrition a/w increased mortality / morbidity

Malnutrition: Post-op Complications

Preoperative malnutrition ↔ Post-op Complications

Weight Loss	Surgical mortality (Peptic Ulcer Dis)
≥ 20%	33% (6/18)
<20%	4% (1/28)

Studley H, JAMA 1936;106:458

Preoperative nutrition support ↔ Post-op Complications

N=1085 screened with NRS-2002

NRS-2002 score ≥ 5 (n=120)

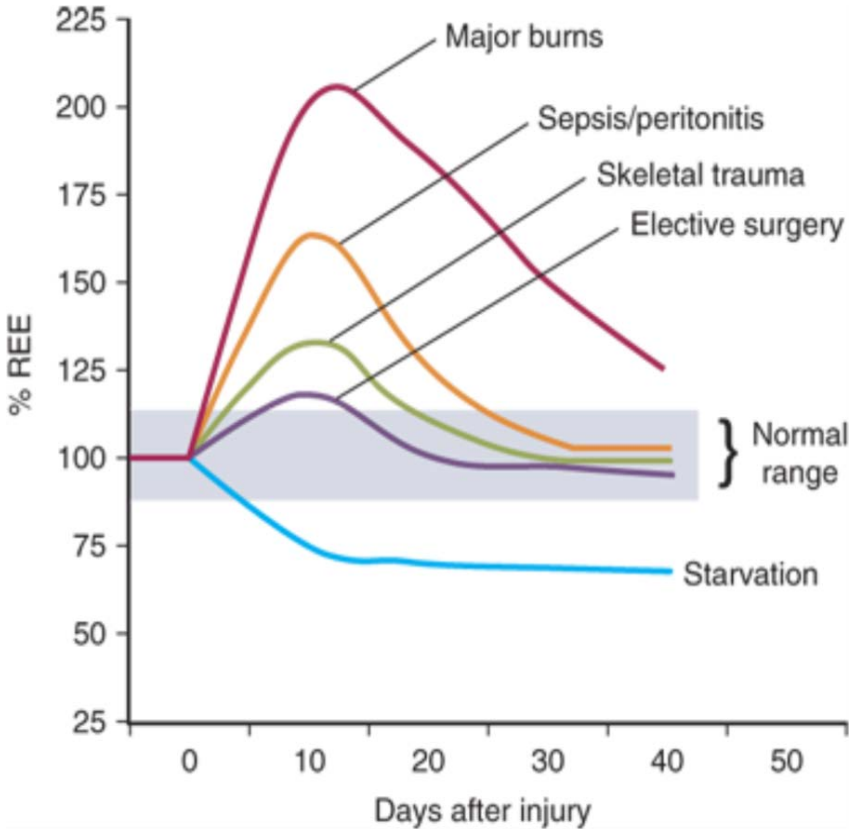
Morbidity	25.6% vs 50.6%	(p=0.008)
LOS	13.7 d vs 17.8 d	(p=0.018)

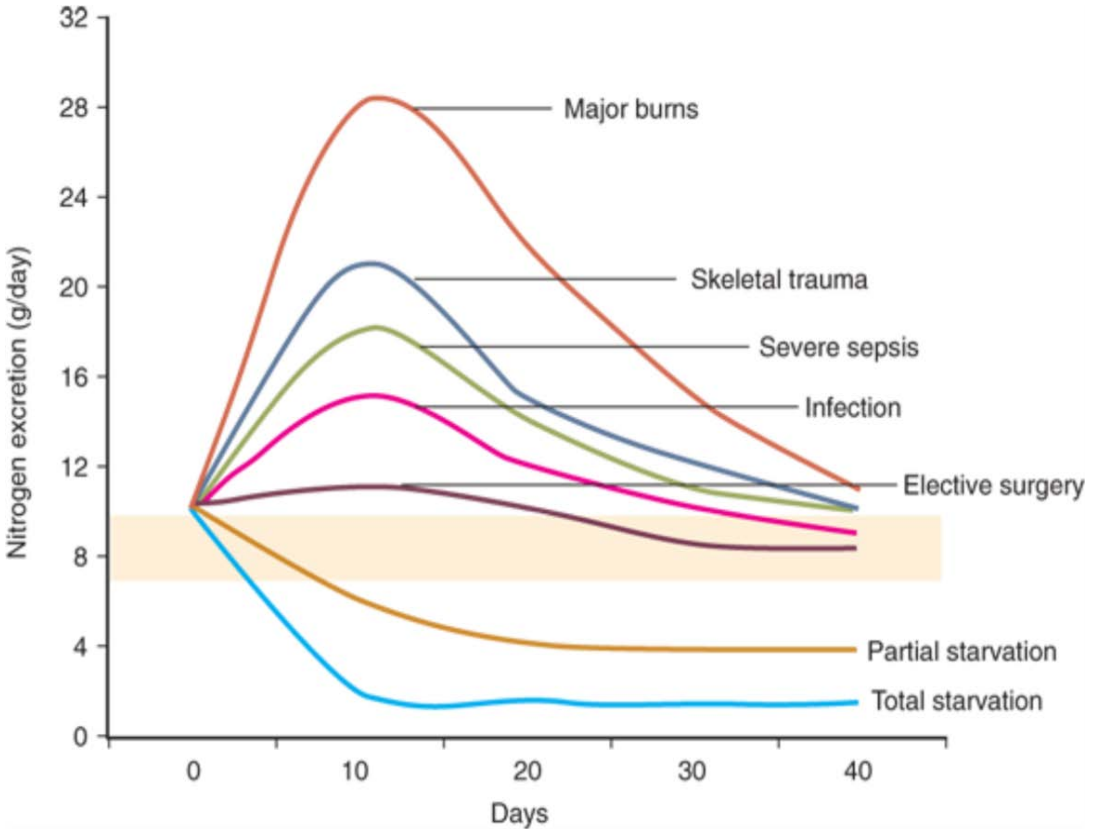
Jie B, Nutrition 2012; 1022

Malnutrition: Consequences in Surgical Patients

- Increased susceptibility to infection
- Poor wound healing
- Increased frequency of decubitus ulcers
- Overgrowth of bacteria in the gastrointestinal tract
- Abnormal nutrient losses through the stool
- Immune system dysfunction
  - complement activation and production
  - bacterial opsonization
  - function of neutrophils, macrophages, lymphocytes
  - subnormal skin reactions to Candida
  - low levels of antibodies to various phytomitogens, suggesting that humoral and cell-mediated immunity are affected
- Increase mortality
- Increase LOS
- Increase treatment cost

Effect of Injury on REE and Nitrogen Excretion

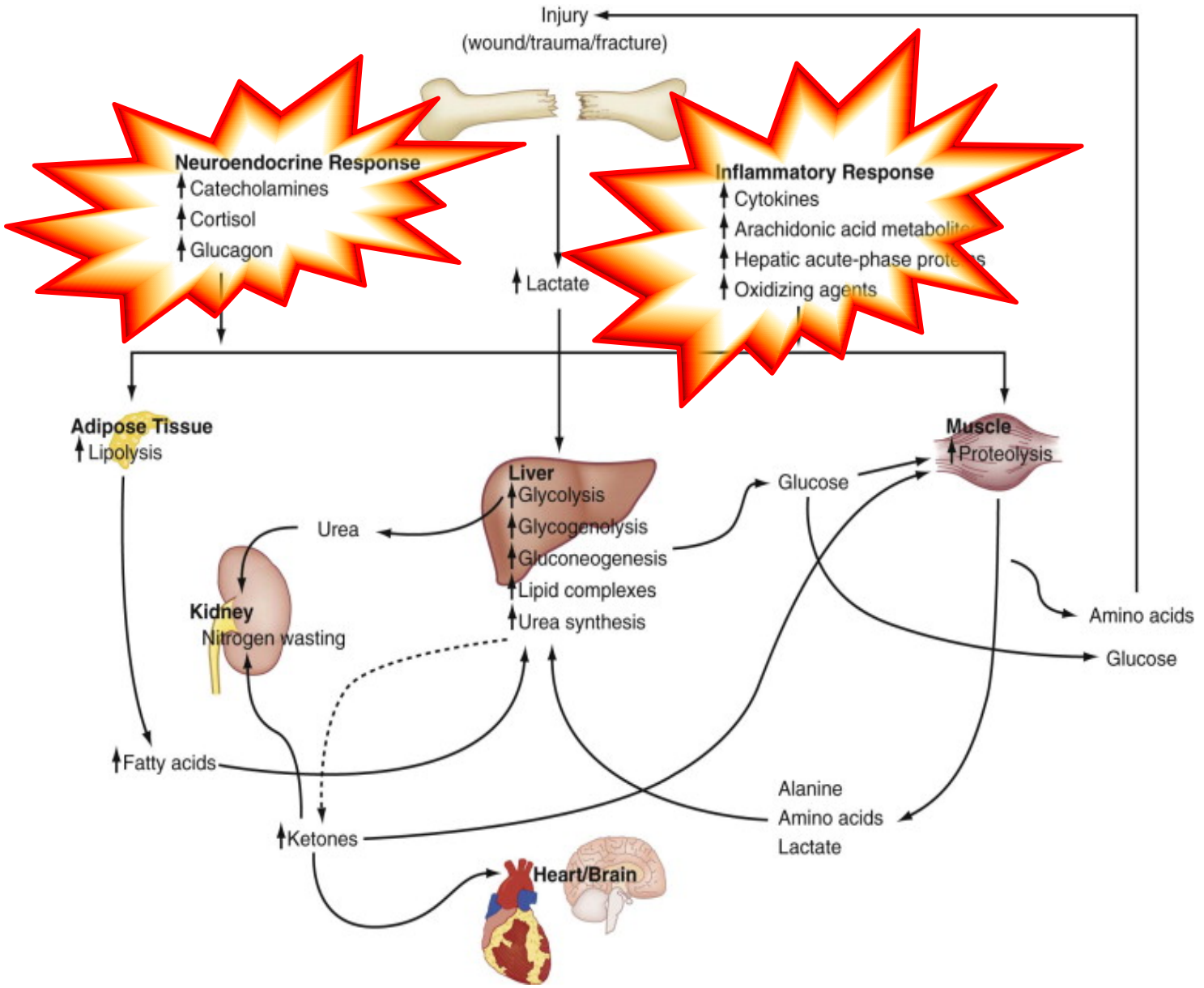




Influence of injury severity on resting metabolism (resting energy expenditure, or REE). The shaded area indicates normal REE. (From Long CL, Schaffel N, Geiger J, et al. Metabolic response to injury and illness: estimation of energy and protein needs from indirect calorimetry and nitrogen balance. JPEN J Parenter Enteral Nutr. 1979;3(6):452. Copyright © 1979 by A.S.P.E.N. Reprinted by permission of Sage Publications.)

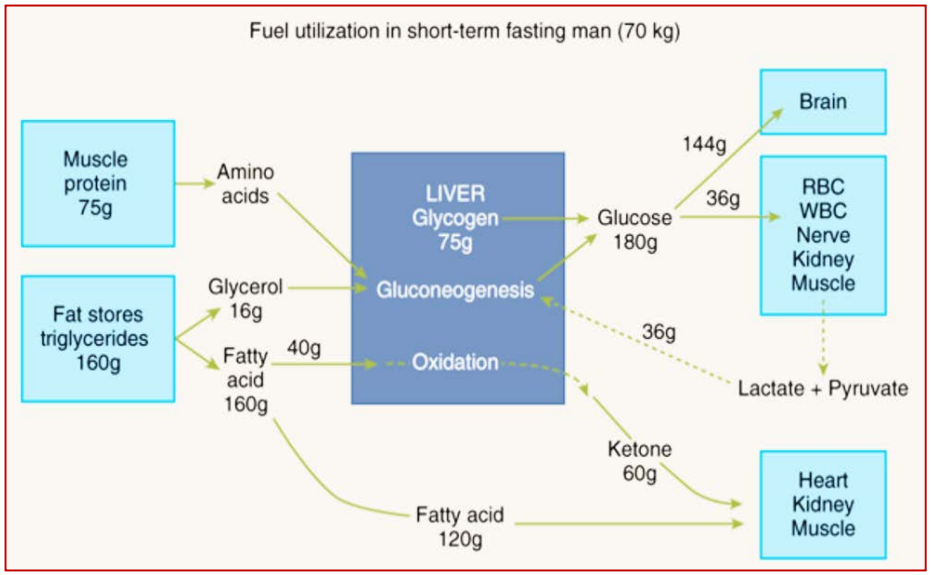
The effect of injury severity on nitrogen wasting. (From Long CL, Schaffel N, Geiger J, et al. Metabolic response to injury and illness: estimation of energy and protein needs from indirect calorimetry and nitrogen balance. JPEN J Parenter Enteral Nutr. 1979;3(6):452. Copyright © 1979 by A.S.P.E.N. Reprinted by permission of Sage Publications.)

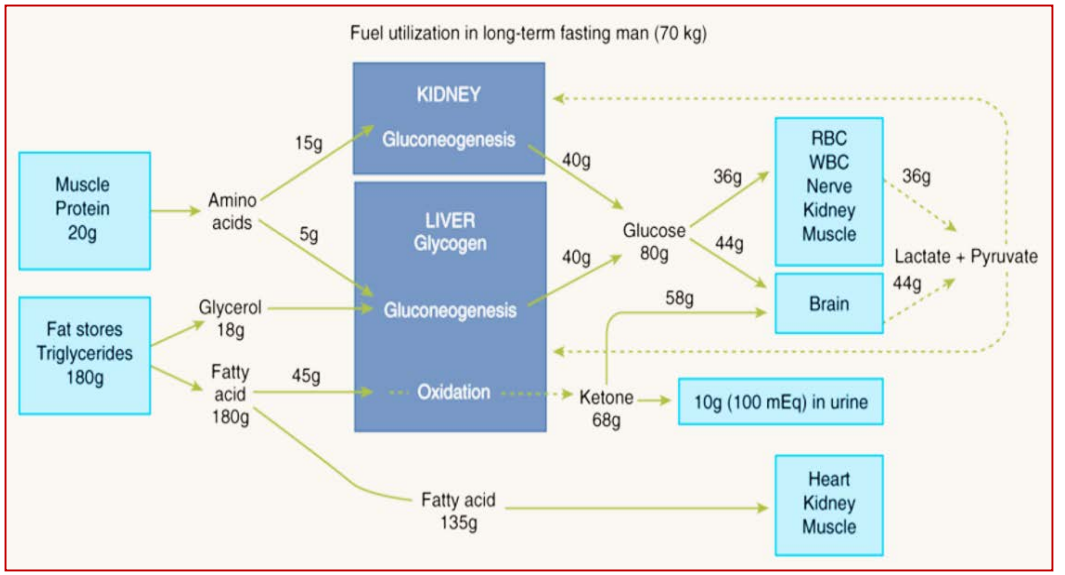
Metabolic Response to Injury



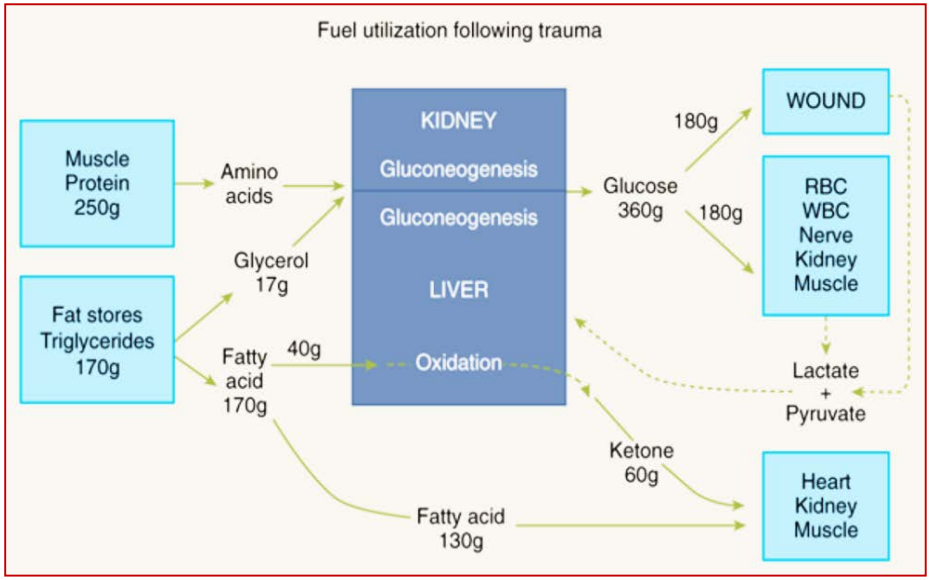
Sabiston Textbook of Surgery, Chapter 6, 120-150

Fuel Utilisation during Starvation



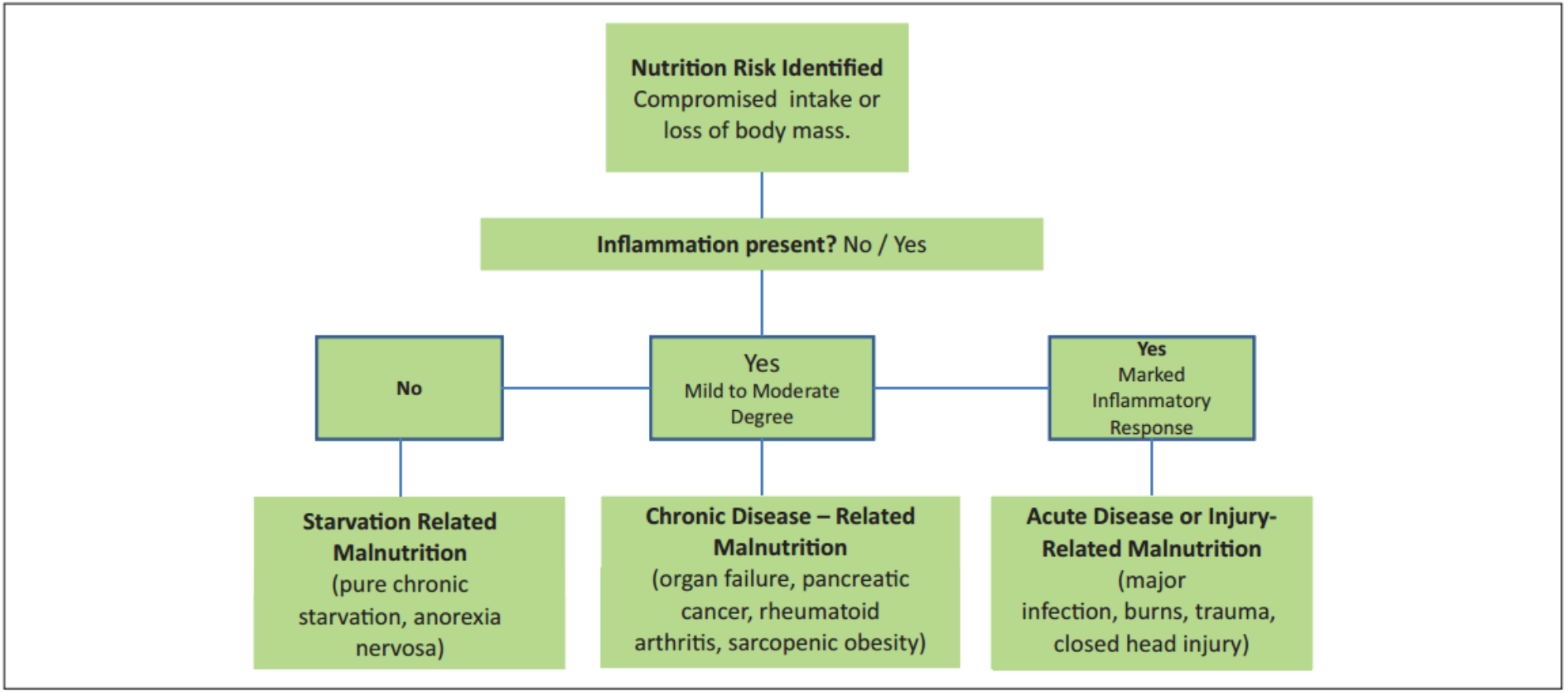


Injury



Fuel utilization in a 70-kg man during short-term fasting with an approximate basal energy expenditure of 1800 kcal. During starvation, muscle proteins and fat stores provide fuel for the host, with the latter being most abundant. RBC = red blood cell; WBC = white blood cell. (Adapted from Cahil l GF: Starvation in man. N Engl J Med. 1970;282:668.)
Fuel utilization in extended starvation. Liver glycogen stores are depleted, and there is adaptive reduction in proteolysis as a source of fuel. The brain uses ketones for fuel. The kidneys become important participants in gluconeogenesis. RBC = red blood cell; WBC = white blood cell. (Adapted from Cahill GF: Starvation in man. N Engl J Med. 1970;282:668.)
Acute injury is associated with significant alterations in substrate utilization. There is enhanced nitrogen loss, indicative of catabolism Fat remains the primary fuel source under these circumstances.

Malnutrition: Etiology-based Definations



JPEN J Parenter Enteral Nutr. 2009;33:710.

Steps in Providing Nutritional Support

- Nutritional Screening/Assessment
- Nutrition Support
  - Oral supplementation
  - Enteral / Parenteral feeding
- Monitoring and follow up

Nutritional Screening and Nutritional Assessment

Nutritional Screening	Nutritional Assessment
• Identify characteristics of nutritional problems • Identify patient at risk	• Detailed evaluation by history, physical examination, labs • Classify patient by nutritional state
Malnutrition Universal Screening Tool (MUST) (community) Nutritional Risk Screening -2002 (NRS-2002) (adult, hospitalised) Mini Nutritional Assessment (MNA) (geriatrics)	Subjective Global Assessment (SGA) (cancer, transplantation, geriatrics, chronic liver disease, stroke, pregnancy)

Table 1 Initial screening

		Yes	No
1	Is BMI <20.5?		
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		

Yes: If the answer is 'Yes' to any question, the screening in Table 2 is performed.
No: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

Table 2 Final screening

	Impaired nutritional status		**Severity of disease (≈ increase in requirements)**
Absent **Score 0**	Normal nutritional status	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss >5% in 3 mths or Food intake below 50–75% of normal requirement in preceding week	Mild **Score 1**	Hip fracture* Chronic patients, in particular with acute complications: cirrhosis*, COPD*. *Chronic hemodialysis, diabetes, oncology*
Moderate **Score 2**	Wt loss >5% in 2 mths or BMI 18.5 – 20.5 + impaired general condition or Food intake 25–60% of normal requirement in preceding week	Moderate **Score 2**	Major abdominal surgery* Stroke* *Severe pneumonia, hematologic malignancy*
Severe **Score 3**	Wt loss >5% in 1 mth (>15% in 3 mths) or BMI <18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week in preceding week.	Severe **Score 3**	Head injury* Bone marrow transplantation* *Intensive care patients (APACHE>10).*
Score:	+	**Score:**	**=Total score**
Age	if ≥70 years: add 1 to total score above	**=age-adjusted total score**	

Score ≥3: the patient is nutritionally at-risk and a nutritional care plan is initiated
Score <3: weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

NRS-2002 is based on an interpre-tation of available randomized clinical trials.
*indicates that a trial directly supports the categorization of patients with that diagnosis. Diagnoses shown in *italics* are based on the prototypes given below.
Nutritional risk is defined by the present **nutritional status** and risk of impairment of present status, due to **increased requirements** caused by stress metabolism of the clinical condition.

A nutritional care plan is indicated in all patients who are

(1) severely undernourished (score=3), or (2) severely ill (score=3), or (3) moderately undernourished + mildly ill (score 2 + 1), or (4) mildly undernourished + moderately ill (score 1 + 2).

Prototypes for severity of disease
Score=1: a patient with chronic disease, admitted to hospital due to complications. The patient is weak but out of bed regularly. Protein requirement is increased, but can be covered by oral diet or supplements in most cases.

Score=2: a patient confined to bed due to illness, e.g. following major abdominal surgery. Protein requirement is substantially increased, but can be covered, although artificial feeding is required in many cases.

Score=3: a patient in intensive care with assisted ventilation etc. Protein requirement is increased and cannot be covered even by artificial feeding. Protein breakdown and nitrogen loss can be significantly attenuated.

Nutritional Risk Scoring -2002
NRS-2002

Nutrition Assessment Tool : Subjective Global Assessment

(Select appropriate category with a checkmark, or enter numerical value where indicated by "#.")

A. History

1. Weight change

Overall loss in past 6 months: amount = # _____ kg; % loss = # _____

Change in past 2 weeks: _____ increase,
_____ no change,
_____ decrease.

2. Dietary intake change (relative to normal)

_____No change,
_____Change _____duration = # _____ weeks
_____type: _____ suboptimal liquid diet, _____ full liquid diet
_____ hypocaloric liquids, _____ starvation.

3. Gastrointestinal symptoms (that persisted for >2 weeks)

_____none, _____nausea, _____vomiting, _____diarrhea, _____anorexia.

4. Functional capacity

_____ No dysfunction (e.g., full capacity),
_____ Dysfunction _____ duration = # _____ weeks.
_____ type: _____working suboptimally,
_____ambulatory,
_____bedridden.

5. Disease and its relation to nutritional requirements

Primary diagnosis (specify) _____

Metabolic demand (stress) : _____ no stress, _____low stress,
_____moderate stress, _____high stress.

B. Physical (for each trait specify: 0 = normal, 1+ = mild, 2+ = moderate, 3+ = severe).

_____loss of subcutaneous fat (triceps, chest)
_____muscle wasting (quadriceps, deltoids)
_____ankle edema
_____sacral edema
_____ascites

C. SGA rating (select one)

_____A = Well nourished
_____B = Moderately (or suspected of being) malnourished
_____C = Severely malnourished

Nutrition Assessment Tool : Subjective Global Assessment

Well validated tool – cancer, transplantation, geriatrics, chronic liver disease, stroke, pregnancy

Scores subjectively based on
7 items on clinical history and
4 items on physical examination

A Well Nourished

B Moderately Malnourished

C Severely Malnourished

A.1 – Weight change over 6 months

A: Weight gain/No change/Mild weight loss
B: Moderate weight loss
C: Severe weight loss

A.2 – Weight change in past 2 weeks

A: Weight is increasing
B: No change in weight
C: Weight is decreasing

A.3 – Change in dietary intake

A: No change or
slight change for short duration
B: Intake borderline and decreasing;
Intake poor and increasing; Intake poor,
No change based on prior intake
C: Intake poor and decreasing

A.4 – Duration and degree of change

A: Less than 2 weeks, little or no change
B: More than 2 weeks, mild to moderate suboptimal diet
C: Unable to eat or starvation

A.5 – Presence of GI symptoms

A: Few or no symptoms intermittently
B: Some symptoms for >2 weeks;
severe symptoms that are improving
C: Symptoms daily or frequently >2 weeks

A.6 –Functional status

A: No impairment in strength, stamina and full functional capacity; mild-moderate loss and improving
B: Mild to moderate loss of strength, stamina / some loss of daily activity or severe loss but now improving
C: Severe loss of function, stamina and strength

A.7 – Disease state and co-morbidity

A: No stress
B: Low or moderate stress
C: High stress

B.1 – Subcutaneous loss of fat

A: Little or no loss
B: Mild-moderate in all areas; severe loss in some areas
C: Severe loss in most areas

B.2 – Muscle wasting

A: Little or no loss
B: Mild to moderate in all areas; severe loss in some areas
C: Severe loss in most areas

B.3 – Edema

A: Little or no edema
B: Mild to moderate edema
C: Severe edema

B.4 – Ascites

A: No ascites or only on imaging
B: Mild to moderate ascites or improving clinically
C: Severe ascites or progressive ascites

Nutritional Assessment

- History
- Physical examination
- Anthropometric measurements
- Laboratory investigations

Nutritional Assessment: History

Dietary history

- 24 hour food recall
- Allergies, preferences, intolerance
- Food frequency
- Related medical history
- Usual eating pattern

Nutritional Assessment: History

Diagnosis of significant weight loss

Time	Significant	Severe
1 week	1%	≥1%
1 month	5%	≥5%
3 month	7%	≥7%
6 month	10%	≥10%

Nutritional Assessment: P/E

Physical Examination

- Hair
- Skin
- Nails
- Eyes
- Oral
- Lips/mucous membranes
- Overall musculature/ fat stores

Nutritional Assessment: Anthropometry

Anthropometry

- Body weight
- Body Mass Index (<18.5)
- Triceps skinfold thickness (TST)
- Mid arm circumference (MAC)
- Bioelectrical impedance
- Hand grip dynamometry

Table 2 The WHO classification of adults according to BMI[2]

Category	BMI (kg/m^2)	Risk of co-morbidities
Underweight	<18.5	Low*
Normal range	18.5 to 24.9	Average
Overweight	≥25.0	
Pre-Obese	25.0 to 29.9	Increased
Obese class I	30.0 to 34.9	Moderate
Obese class II	35.0 to 39.9	Severe
Obese class III	≥40.0	Very severe

* *but increased risk of other clinical problems*

Table 3 Proposed BMI cut-off points for public health action in Asians (adapted from a WHO report)[57]

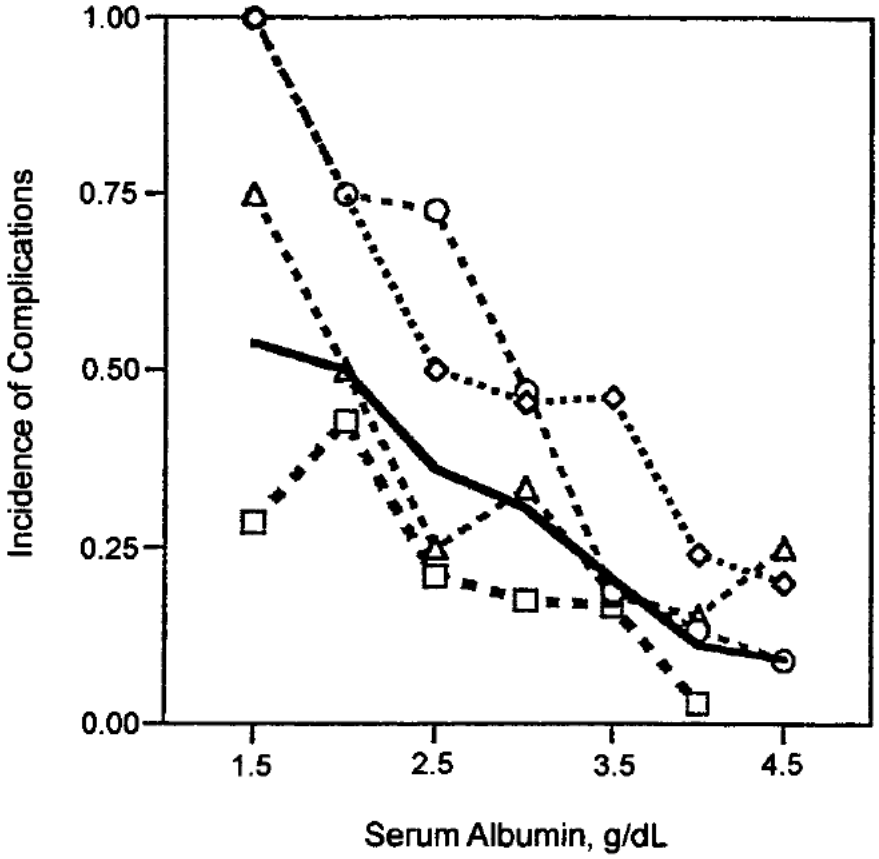
Cardiovascular disease risk	Asian BMI cut-off points for action (kg/m^2)	Current WHO BMI cut-off points (kg/m^2)
	<18.5	<18.5
Low	18.5 to 22.9	18.5 to 24.9
Moderate	23.0 to 27.4	25.0 to 29.9
High	27.5 to 32.4	30.0 to 34.9
Very high	32.5 to 37.4	35.0 to 39.9
	≥37.5	≥40.0

Nutritional Assessment : Labs

Lab investigations

- albumin < 30 mg/dl
- pre-albumin <12 mg/dl
- transferrin < 150 mmol/l
- total lymphocyte count < 1800 / mm3
- creatinine / height index
- nitrogen balance study
- skin anergy testing
- specific nutritional deficits tests

Albumin and Postoperative Complications



— combined sample;
◇ esophagus;
O pancreas;
Δ stomach;
□ colon.

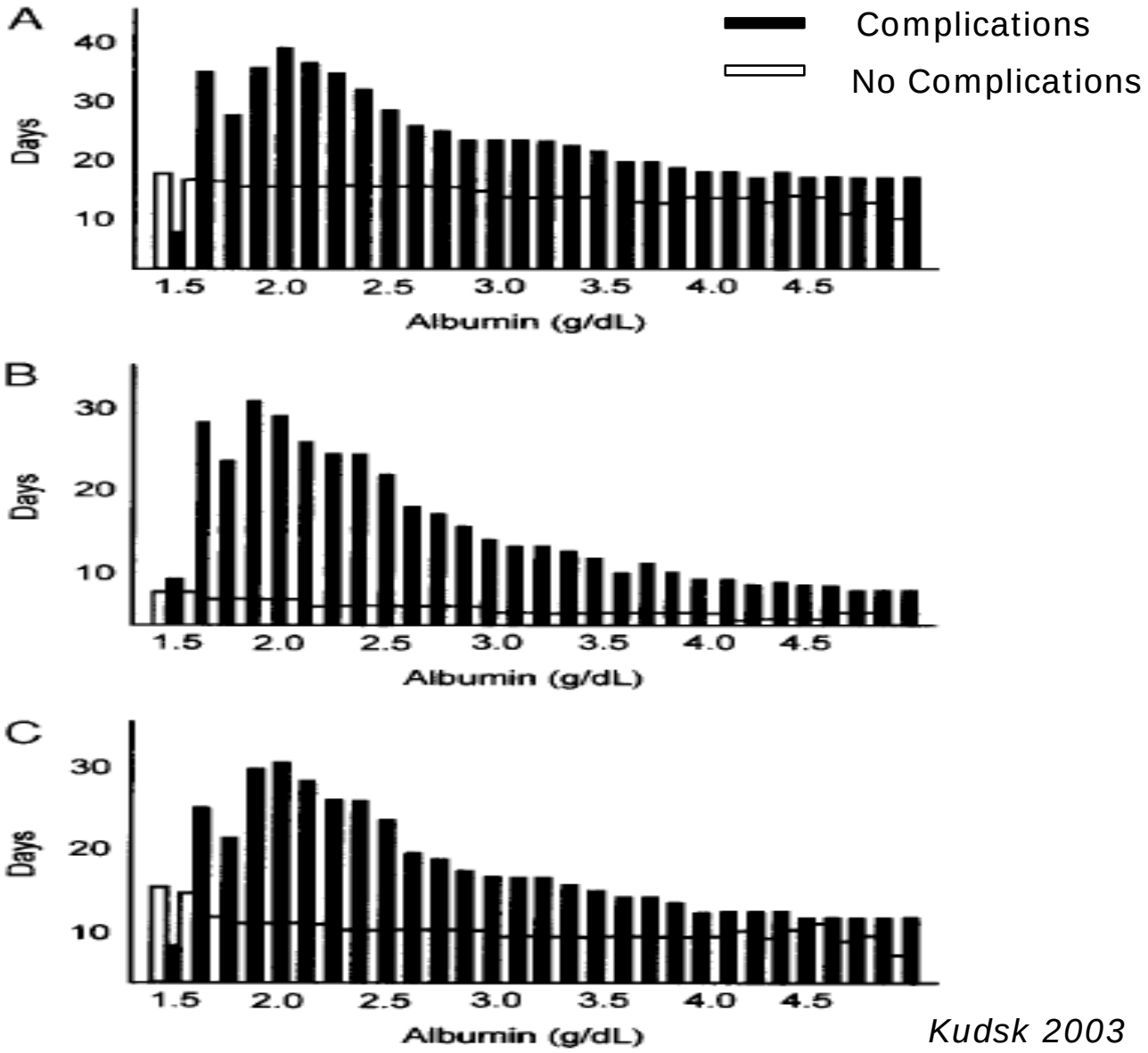
Kudsk 2003

Albumin and Post-op days; ICU days & NPO days

Post op days

ICU Days

NPO days

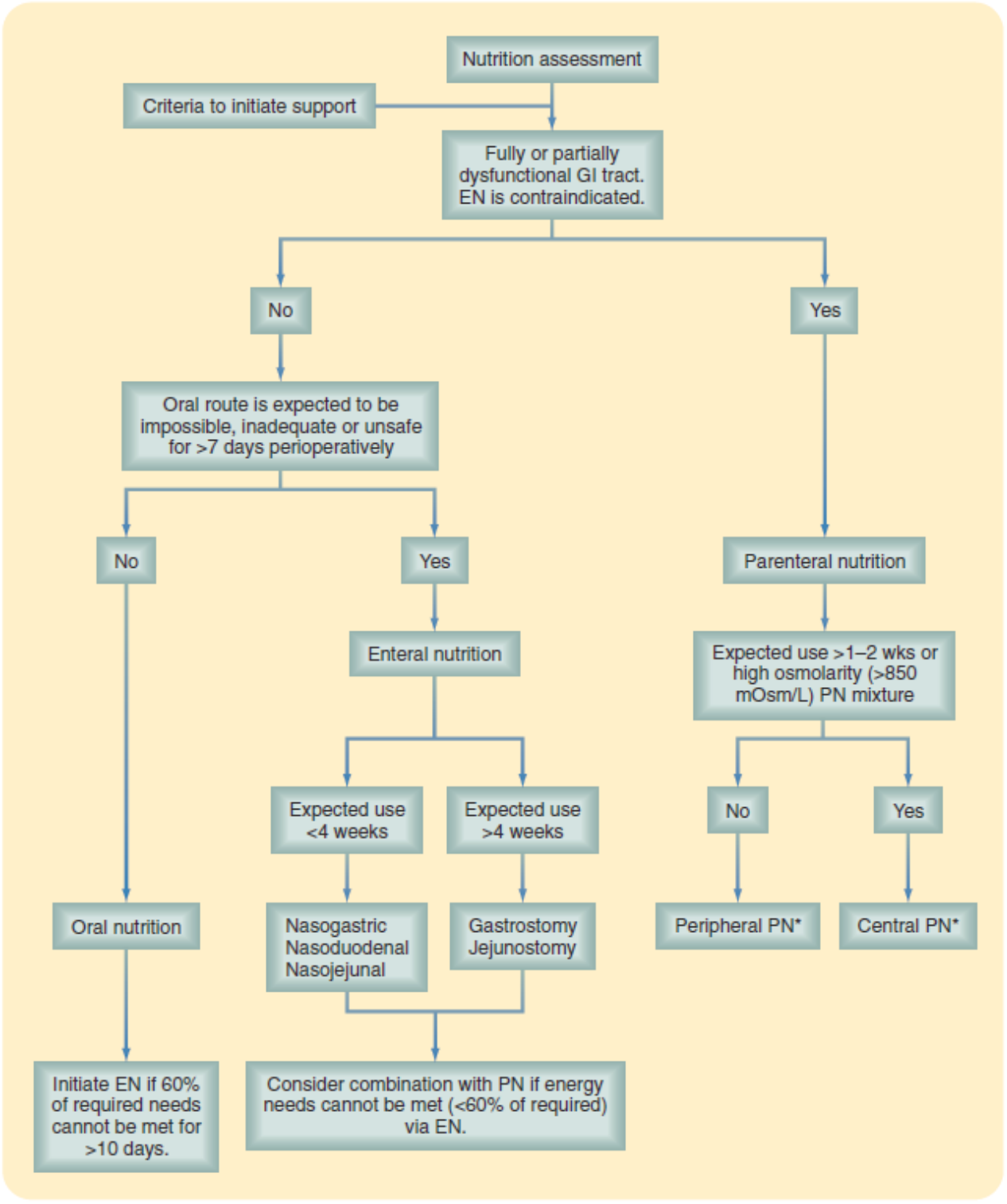


Kudsk 2003

Nutritional Support

- Who? Malnourished / At risk of malnutrition
- Where? Oral / EN / PN
- How much? Calories /Protein
- What ? Composition of Nutrients
- Why? Monitoring and Follow-up

Where? Algorithm for Nutritional Support



Benefits of Enteral Feeding

- Physiologic
- Decrease infectious complications
- Maintains gut integrity
- Maintains immunological integrity
- Less bacterial translocation
- Attenuate catabolic response
- Immunonutrition
- Cheaper

Contraindications for Enteral Feeding

- Active GI bleed
- High output fistula (>500ml/day)
- Intractable vomiting
- Ileus or bowel obstruction
- Profuse diarrhea
- Severe enterocolitis
- Ischaemic bowel
- Aggressive support not warranted

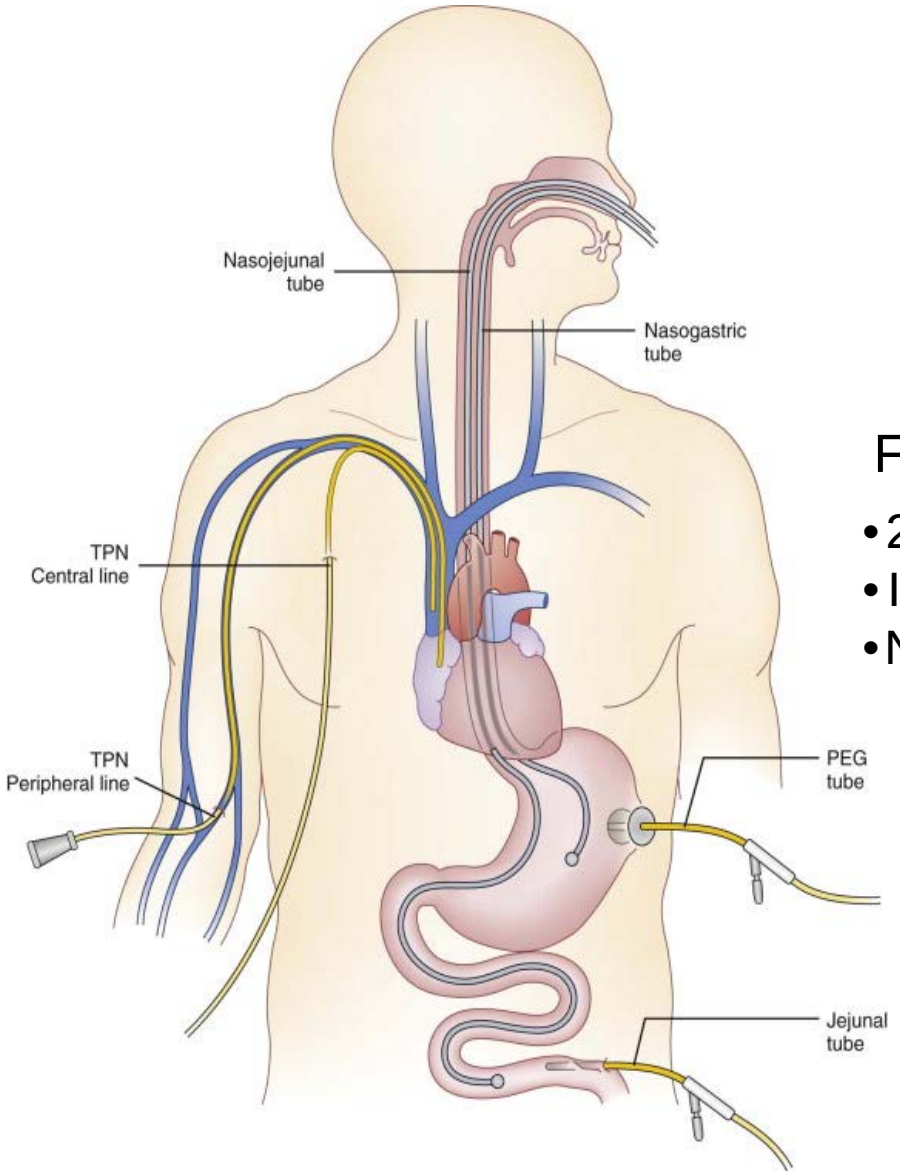
Parenteral Nutrition

- Greater caloric intake
- More expensive
- Complications
- Technical expertise

Indication of Parenteral Nutrition

- Abnormal gut function
- Not able to be fed enterally by 5-7 days
- Prognosis warrants aggressive nutritional support

Where?
Route



Feeding regime

- 24-hour continous
- Intermittent bolus
- Nocturnal, cyclic

Sabiston Textbook of Surgery, Chapter 6, 120-150

How much?
Estimating Energy Needs

Caloric Requirements

- ***Harris-Benedict Equation***
  - *Males BEE = 66 + (13.7Wt) + (5Ht) - 6.8A*
  - *Females BEE= 655 + (9.6Wt) + (1.8Ht) - 4.7A*

Total requirement = *BEE X Injury Factor X Activity Factor*

- ***25 to 30 kcal/kg/day***

Caloric Requirements

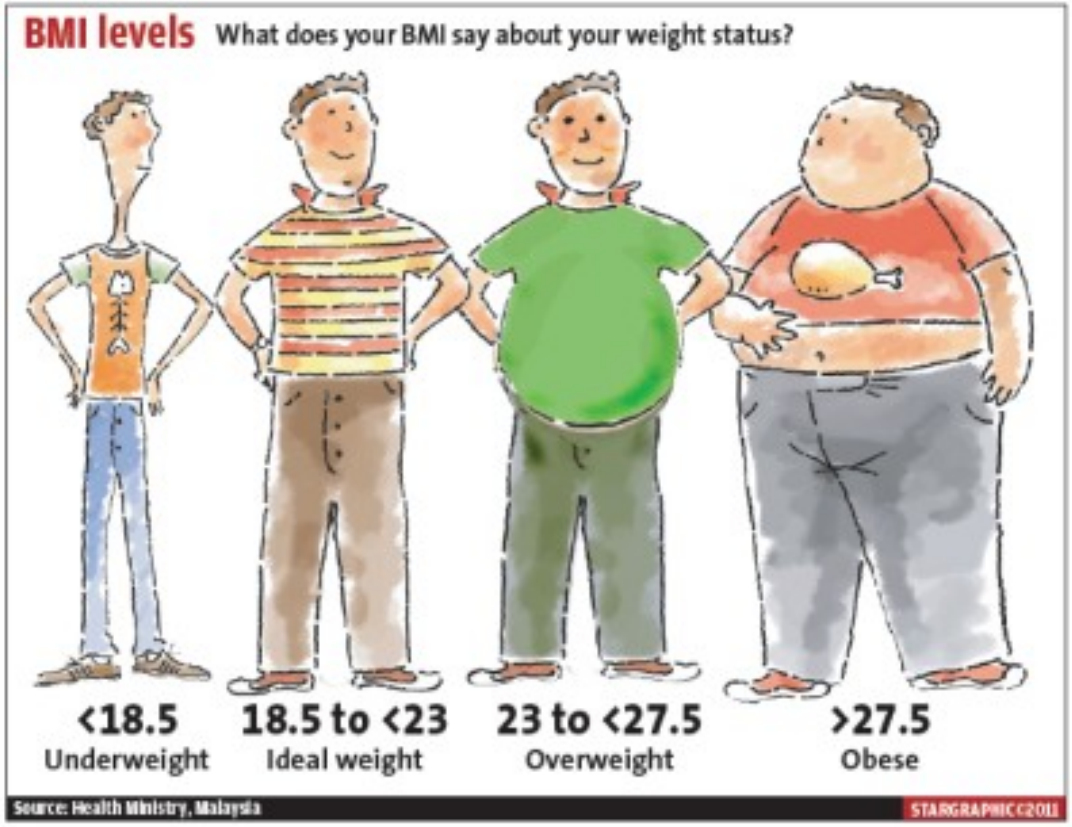
Injury Factor

Peritonitis	1.15
Soft tissue trauma	1.15
Fracture	1.20
Fever (per ^{o}c rise)	1.13
Moderate infection	1.20
Severe infection	1.40
<20% BSA burns	1.50
20-40% BSA burns	1.80
>40% BSA burns	2.00

Activity Factor

Bed bound	1.2
Ambulatory	1.3

How much?
Estimating Energy Needs
Underweight Patients



Energy expenditure must be calculated with **actual weight**

How much?
Estimating Energy Needs
Obese Patients

	A	B	C	D	E	F	G	H	I	J
Weight by Measured BMI	Under weight	Normal weight		Over weight	Class I Obesity		Class II Obesity		Class III Obesity	

Adjusted body weight

= Ideal Body Weight +0.4(actual weight - ideal body weight)

Ideal body Weight
Man: 48kg for first 150cm, 2.7kg/2.5cm thereafter
Woman: 45.5kg for first 150 cm, 2.2kg/cm thereafter

How much?
Estimating Protein Requirements

- **Based on calorie : nitrogen ratio**
  - Normal ratio 150 cal : 1g N
  - Critically ill patients 85-100 cal : 1 g N

- **Based on degree of stress & body weight**

Non-stress patients	0.8 g / kg / day
Mild stress	1.0 to 1.2 g / kg / day
Moderate stress	1.3 to 1.75 g / kg / day
Severe stress	2 to 2.5 g / kg / day

- **Based on Nitrogen Balance**

  Positive balance of 1.5 to 2g / kg / day

Types of Enteral Feeds

- Blenderised feeds
- Commercially prepared feeds
  - *Polymeric*
    - *e.g. Isocal, Ensure, Jevity*
  - *Modular/Disease specific*
    - *e.g. Suplena, Nepro, Pulmocare, Hepaticaid,Glucerna*
  - *Elemental/Semi-elemental/Monomeric*
    - *e.g. Vivonex, Alitraq*

Complications of Enteral Feeding

- **Gastrointestinal complications**
  - ✓Distension
  - ✓Nausea and vomiting
  - ✓Diarrhoea / Constipation
- **Mechanical complications**
  - ✓Malposition/ Blockage of feeding tube
  - ✓Sinusitis
  - ✓Ulcerations / erosions
- **Metabolic complications**
- **Infectious complications**
  - ✓Aspiration pneumonia
  - ✓Bacterial contamination

Parenteral Nutrition

- Peripheral (Partial/Total) Parenteral Nutrition
- Central (Total) Parenteral Nutrition
  - *method of administration*
  - *composition of feed*
  - *primary caloric source*
  - *potential complications*

What to Do Before Starting TPN

- Nutritional Assessment
- Baseline weight
- Venous access evaluation
- Baseline lab investigations

Baseline Investigations

- Full blood count
- Coagulation screen
- U/E/Cr
- Ca^{++}, Mg^{++}, PO_4^{2-}
- TG / Cholestrol
- Liver Panel
- Other tests when indicated

Steps to Ordering TPN

1. Volume
2. Calculate Caloric requirement
3. Calculate Protein requirement
4. Determine Dextrose requirement
5. Leftover calories as Lipids
6. Electrolytes
7. Micronutrient
8. Additives

Volume

- **Maintenance requirements**
  - Body weight
  - 30 to 50 ml/kg/day
- **On going losses + insensible fluid losses**

  add 10% for every ^{o}C rise in temperature
- **Fluid restriction**

  CCF, ESRF

Macronutrients

2. Calculate Caloric requirement
   70 kg x 25 kcal/kg = **1,750 Cal**

3. Calculate Protein requirement
   70 kg X 1.2 g protein/kg = **84 g Protein**
   84 X 4 kcal/g protein = 336 Cal

4. Determine Dextrose requirement
   55% calories from carbohydrate
   1,750 x 0.55 = 962 Cal
   962 ÷ 3.4 (kcal/g dextrose) = **283 g Dextrose**

5. Leftover calories as Lipids
   1,750 – (336 prot cal + 962 dextrose cal) = 452 Cal
   452 ÷ 10 (kcal/g lipid) = **45 g Lipid**

How Much CHO & Fats?

CHO usually form 50-70 % of calories

< 7 g/kg/day (max glucose oxidation: 4-5mg/kg/min)

Blood sugar 8-10 mmol/L

Fats usually form 20 to 40% of calories

- Not more than 50%
- < 1g/kg/day
- Increase usually in severe stress
- Aim for serum TG levels < 350 mg/dl or 4.2 mmol/L

Electrolyte Requirements

Maintenance + Replacement

Na^+	1 to 2 mmol/kg/d	(60-120 mmol/d)
K^+	0.5 to 1 mmol/kg/d	(30 - 60 mmol/d)
Mg^{++}	0.35 to 0.45 meq/kg/d	(10 to 20meq/d)
Ca^{++}	0.2 to 0.3 meq/kg/d	(10 to 15 meq/d)
PO_4^{2-}		(10 to 20mmol/d)

Trace Elements & Vitamins

Commercial Trace Element preparations provide RDA

Zn	2-4 mg/day
Cr	10-15 ug/day
Cu	0.3 to 0.5 mg/day
Mn	0.4 to 0.8 mg/day
Se	20-40 mcg/day
Mb	20-13

Vitamins

2-3x that recommended for oral intake

1 ampoule MultiVit per bag of TPN

MultiVit does not include Vit K

(1 mg/day or 5-10 mg/wk)

Monitoring of patient

Monitoring

- Clinical review
- Investigations

Complications Related to TPN

- Mechanical Complications
- Metabolic Complications
- Infectious Complications

Mechanical Complications

Related to vascular access technique

- pneumothorax
- air embolism
- arterial injury
- bleeding
- brachial plexus injury
- catheter malplacement
- catheter embolism
- thoracic duct injury

Related to catheter in situ

- Venous thrombosis
- Catheter occlusion

Metabolic Complications

Abnormalities related to excessive or inadequate administration

- hyper / hypoglycaemia
- electrolyte abnormalities
- acid-base disorders
- hyperlipidaemia

Hepatic complications

- Liver steatosis
- Cholestatic liver disese
- Cholelithiasis/Acalculous cholecystitis

Bone Disease

- Bone pain
- Fractures
- Increased SAP, hypercalciuria

Infectious Complications

Insertion site contamination

Catheter contamination

- improper insertion technique
- use of catheter for non-feeding purposes
- contaminated TPN solution
- contaminated tubing

Secondary contamination

- septicaemia

Stopping PN

When? Enteral feeding tolerated

How? Wean to avoid hypoglycaemia

Monitor hypocount

Give IV Dextrose 10% solution at previous infusion rate for 4 h

Half TPN rate X 2 hours for patient

Role of Perioperative Nutrition

Grain

versus

Vein

Role of Post-operative PN

Table 2. Prospective, randomized trials of postoperative TPN.

Study	No. of patients	Nonprotein calories (kcal/kg/day)	TPN duration (days)	Complications (%)		
				TPN	Control	p
Brennan [22]	117	30–35	12	45.0	22.8 ←	<0.02
Collins [23]	20	37	13	→ 20.0	90.0	<0.01
Holter [24]	56	30	10	13.3 ↔	19.2	NS
Jensen [25]	20	40–50	6	10.0 ↔	40.0	NS
Preshaw [26]	47	40	5	33.0 ↔	17.4	NS
Reilly [27]	28	35	7	NR	NR	—
Sandstrom [28]	300	29	9	27.3	16.0 ←	<0.05
Woolfson [29]	122	35	≥6	9.7 ↔	6.7	NS

The effect of postop IV feeding(TPN) on outcome following major surgery evaluated in a randomised study

Sandstrom , Ann Surg 1993, 217:185

No diff in mortality, Major Cx increased

A PRT of TPN after major pancreatic resection for malignancy

Brennan, Ann Surg 1994;220:436

Major Cx increase 2 X, Mortality increased 3.5 X

Role of Preoperative PN

Table 1. Prospective, randomized trials of preoperative TPN.

Study	No. of patients	Nonprotein calories (kcal/kg/day)	TPN duration (days)	Complications (%)		
				TPN	Control	*p*
Bellantone [8]	100	30	≥7	14.8	7.8	<0.001
Bellantone [9]	100	30	≥7	30.0	35.3	NS
Fan [10]	124	30	7	34.0	55.0	<0.02
Fan [11]	40	>40	14	85.0	75.0	NS
Heatley [12]	19	40	7–10	23.7	44.4	<0.05
Meguid [13]	66	35	8	31.3	56.0	<0.03
Muller [14]	105	32–46	7–14	37.0	32.2	NS
Muller [15]	125	40	7–14	16.7	32.2	<0.01
Moghissi [16]	15	34–36	5–7	0.0	80.0	<0.05
Smith [17]	34	50–60	8–15	17.6	35.3	NS
Thompson [18]	21	40–50	6–14	16.7	11.1	NS
VA [19]	395	45	7–15	25.5	24.6	NS
Von Meyenfeldt [20]	101	35–40	10–23	12.0	14.0	NS

Role of Perioperative PN

Perioperative TPN in surgical patients.VATPNCSG

NEJM 1991, 22;325:525

RCT Preop + 3day post op PN vs No PN (7-15 days)

N=396
Follow up : 90 days
No difference in mortality
Infective Cx: *TPN > Ctrl (14.1% vs 6.4%; p<0.01)*
Non-infective Cx: *Ctrl > TPN (22.2% vs 16.7%; p=0.2)*

Severely malnourished:
Infective Cx: *TPN = Ctrl*
Non-infective Cx: *TPN < Ctrl (5% vs 43%; p=0.03)*

Use of preop TPN should be limited to severely malnourished

Early Enteral Nutrition

Defination: enteral feeding within 48 hour of injury (trauma/surgery) or admission to ICU

Physiology: Gastric/Colonic atony 24-48H
Small Bowel ileus 4-6 hours

Advantages

- preserve gut mucosa mass
- prevent mucosal atrophy
- maintains normal gut flora
- reduce bacterial translocation
- stimulates gut secretion of IgA

Disadvantages

- Abdominal distension, pain
- Vomiting, diarrhea

Early Enteral Nutrition

Table 1. Early Enteral Feeding Meta-Analyses.

Author/Journal	Study Parameters	Study Design	Outcome
Marik, *CCM* 2001 (medical ICU patients)	Feeding < or > 36 hr	15 studies, 753 patients	↓ Infections ↓ LOS
Lewis, *BMJ* 2001 (surgery patients)	NPO vs <24 hr	11 studies, 837 patients	↓ Infections ↓ LOS ↑ Vomiting risk
Heyland *JPEN* 2003 (medical ICU patients)	<24-48 hr	8 studies	Trend to ↓ infections and mortality
Lewis SJ, *J GI Surg 2008* (surgery patients)	<24 hr	13 studies, 1173 patients	Decrease mortality
Doig GS, *Int Care Med 2009* (critically ill patients)	<24 hr	5 studies	Decrease infection and mortality
Osland E, *JPEN 2011* (GI surg with resection)	<24 hr	15 studies, 1240 patients	45% decrease in morbidity, no increase anastomotic leak
Doig GS, *Injury 2011* (trauma patients)	<24 hr	3 studies	Decrease mortality

LOS, length of stay.

Early Enteral Nutrition

Table 2. Early Feeding in the Surgical Populations: Why Is It Such a Problem Getting Enteral Nutrition Started?

- Lack of team understanding of the potential benefits of early feeding
- Poor understanding of postop ileus
- Waiting for flatus or signs of "bowel activity"
- Concern for complications
  - Aspiration
  - Ischemic bowel
  - Feeding will cause a "leak" of recent bowel anastomosis
- Lack of skills for tube placement
- Perception of inability to feed while on "pressors"
- Lack of communication between team members

Early Enteral Nutrition

Table 3. Early Feeding in Postop Setting: Can It Be Done Safely?

Author	Year	N	Population	Timing	Success (%)
McDonald	1991	106	Burn	6 h	85
McCarter	1997	167	UGI	24 h	78
Heslin	1997	195	UGI Ca	24 h	80
Velez	1997	46	GI	6 h	81
Hedberg	1999	225	Postop	12 h	85
Braga	2002	650	Postop	12 h	91
DiFronzo	2003	86	Colon (postop)	48 h	97
James	2004	170	Whipple	24 h	85
Mosier	2011	153	Major burn	24 v 48	88

Ca, cancer; GI, gastrointestinal; UGI, upper gastrointestinal.

Perioperative Nutrition Support

Preoperative NS is indicated in *severely malnourished* patients undergoing major GIT surgery for 7-14 days if op can be safely postponed

Enteral nutrition is the preferred route for periop NS

Postoperative PN should not be routinely given in the immediate postoperative period

Postoperative PN should be administered to patient who is anticipated to be unable to meet their nutritional needs (orally/enterally) for a period of 7-14 days

Immunonutrition

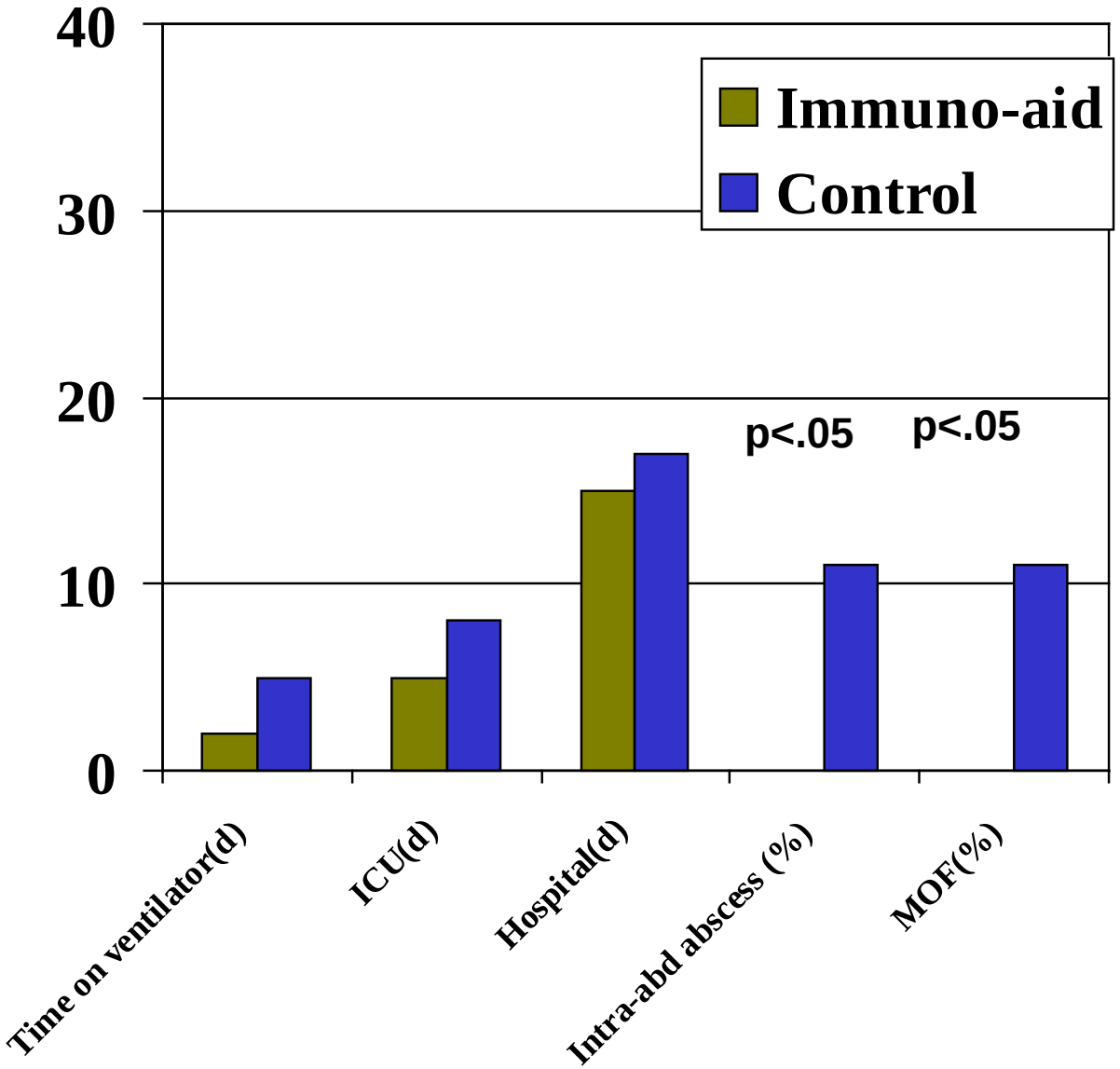
Components: arginine, glutamine,nucleic acids, O-3FA, antioxidants

Mechanism: modulates immune response
modulates inflammatory response
improves gut function

Impact, ImmunAid

Clinical Benefits of Immune Enhancing Diet for Early Postinjury Enteral Feeding.

Moore et al 1994

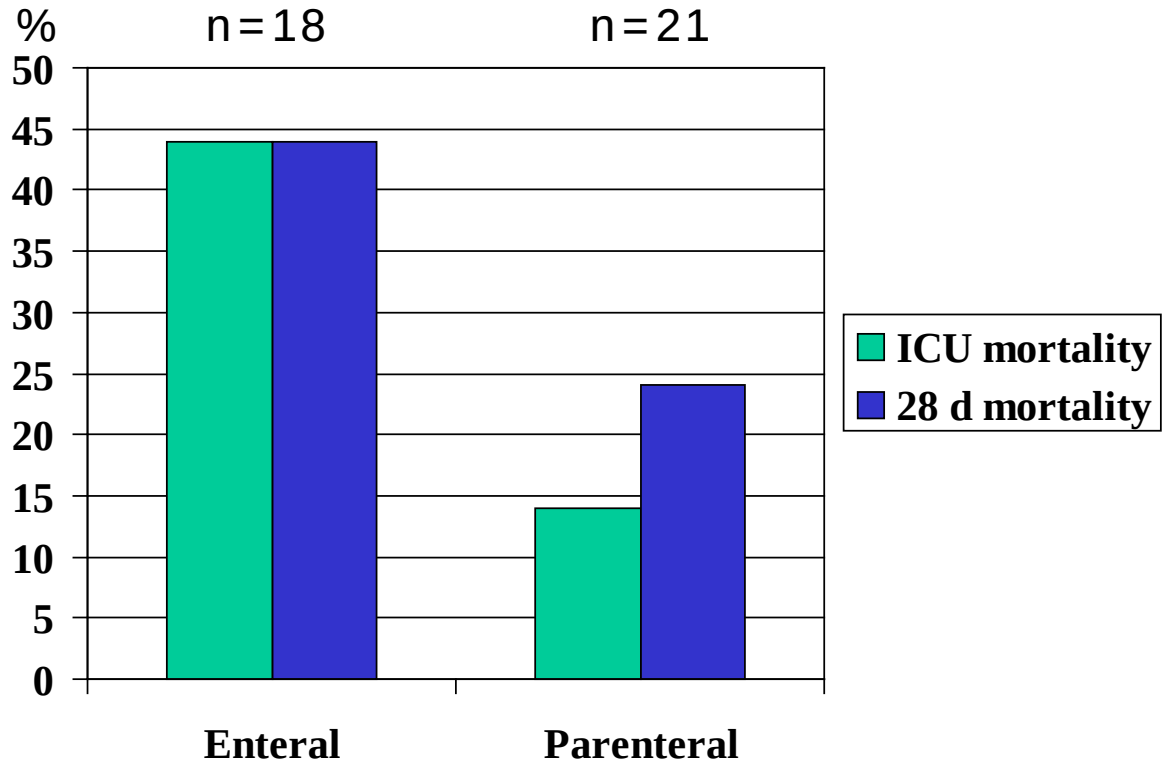


Early enteral immunonutrition in patients with severe sepsis

Bertolini et al Int Care Med 2003, 29:834

Italian Group for the evaluation of interventions in Intensive Care Medicine(GiViTI)

Multicentre RCT of critically ill to EEN(I) vs PN
Objective: n=1 500, power=80%, mortality difference 7%
Trial stopped at interim analysis



Immunonutrition

Immunonutrition: A systemic review

Heyland 2001

22 RCT, n=2419

Pooled results

- No difference in mortality (RR1.10)
- Reduced infectious Cx (RR0.66, heterogeneity p<.001)
- Reduced LOS (-3.3 D, heterogeneity p<.001)

Elective Surgical Patients

- No difference in mortality
- Reduced infectious Cx (RR 0.54)p=.002
- Reduced LOS (-3.39D) CI –4.55 to –2.23

Critically Ill Patients

- No difference in mortality
- No difference in infectious Cx
- Reduced LOS (-3.34D) CI –8.27 to –1.45

Immunonutrition

Immunonutrition appear to

- reduce infectious complications
- LOS in elective surgical patients
- Mortality not affected

There are concern about its safety and efficacy
In certain subgroup of critically ill (septic) patients

Immunonutrition

Indications
- Elective GI surgery
- Blunt and Penetrating torso trauma

Relative Indications
- Major vascular surgery req post-op ventilation
- Major Head & Neck surgery
- Severe HI
- Burns
- Ventilator but not septic

Contraindications
- Pre-existing severe sepsis

Thank you