

Nutrition in ICU

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Syllabus

- Nutritional **assessment** techniques including laboratory tests
- Clinical **consequences** of poor nutritional status: including wound healing, infection, cardiovascular stability, thermoregulation, respiratory control
- The role of **artificial nutritional support** in improving surgical outcome – enteral and parenteral. Nutritional supplements
- **Mechanics** of providing parenteral and enteral nutrition and different routes; pre and post pyloric
- **Complications** of parenteral and enteral nutritional support
- Consequences of **overfeeding**
- Changes in **intestinal blood flow** with injury/sepsis/critical illness
- Choice of **artificial nutritional support** in trauma/sepsis/critical illness. Principles of enteral and parenteral feeding including trace elements
- Knowledge of the **vulnerability of certain groups** [very old, very young] to malnutrition and its effects

Nutrition related disorders in critical care

- Malnutrition
- Frailty/Sarcopenia
- Obesity
- Micronutrient abnormalities
- Re-feeding syndrome



Consequences of malnutrition

- Immune suppression
- Muscle weakness
 - Respiratory, Cardiac.
- Renal impairment (impaired salt regulation)
 - Hyper/hypovolaemia
- Neuro
 - Apathy, depression.
- Anaemia
- Impaired temperature regulation
- Impaired wound healing

Consequences of overfeeding

- CO₂ production
- Uraemia
- Hypermetabolism
- Hypertriglyceridemia
- Hepatic steatosis

Assessment

- Malnutrition universal screening tool (**MUST**)
 - All hospital admissions.
- **NUTRIC**
 - Critical care admissions.
- **General clinical assessment**
 - Hx (normal weight, hx of loss)
 - Ex (Oedema, BMI, muscle bulk)
 - Grip strength, mid arm circumference
- **Calculate energy expenditure**
 - Caloric testing, VO_2 , VCO_2 , (PA catheter and ventilator).
 - Equations Benedict-Harris

Lab tests

- Blood; Glucose, B12/Folate, Ferritin, TTG, TFTs, Cortisol, HIV, magnesium, phosphate, CRP, albumin.
- Stool; Calprotectin, Elastase, Culture.

Peri-op

- Wound Healing
- Hospital length of stay
- Complications of surgery
- Organ dysfunction post surgery

Oral

- Food charts
- Shakes and supplements
- Good nursing care
- Mix with food

Methods

- Enteral

	Ix	Placement	Issues
NG	<30 days Stroke Inadequate oral		Displacement
NJ	Gastric emptying GI/oesoph pathology	Endoscopy Bedside magnetic imager	Block and kink

Methods

PEG	Head/neck/neuro/p oesophagus pathology. >30 days	Endo/radio/surg	Abscess Displacement Leakage
PEJ	Gastroparesis	Endo/radio/surg	Abscess Displacement Leakage Blockage

Lines

- **CVC with dedicated port**
- PICC upto 3 months
- Hickman line if over 3 months

Complications

- Line
 - Ulceration
 - Infection
 - Discomfort
 - N and V
 - Aspiration pneumonia
- Insertion
 - Pneumothorax
 - Bleeding
- Feed
 - Hyperglycaemia
 - Sepsis
 - Refeeding syndrome
 - Electrolyte imbalance
 - Wernickes
 - (Deranged LFTs)
 - (Pancreatitis)

Daily nutritional requirements

Component	Amount
Water	30ml/kg/day
Na and Cl	1-2mmol/kg/day
K	0.8-1.2mmol/kg/day
Ca ² and Mg ²	0.1mmol/kg/day
Phosphate	0.2-0.5mmol/kg/day
Fat	1.5g/kg/day
Protein	1.3g/kg/day
Carbohydrate	5mg/kg/day

ESPEN recommendations

1. To commence nutritional support within 48hrs
2. General clinical assessment
3. Every critically unwell patient >48hrs should be considered at risk of malnutrition
4. Oral preferred to EN preferred to PN
5. Hypocaloric in early phase, progress to full in 3-7 days
6. Continuous rather than bolus EN
7. Gastric preference for EN
 - Post pyloric if IV erythromycin/metoclopramide fails
 - Or high risk aspiration
8. In ventilated patients energy expenditure should be determined using indirect calorimetry, if not available VO_2/VCO_2
9. Physical therapy may enhance beneficial effects of nutrition
10. Protein; 1.3g/kg/day, Fat 1.5g/kg/day, Carb 5mg/kg/day
 - No enteral nutrition in uncontrolled shock

ESPEN 2

- Delay EN in
 - Uncontrolled shock
 - Life threatening hypoxaemia/hypercapnia/acidosis
 - Active UGIB
 - Overt bowel ischaemia
 - High output fistula without distal access
 - Abdo compartment syndrome
 - Gastric aspirate >500ml/6hr

ESPEN 3

- Low dose EN in;
 - Therapeutic hypothermia
 - IAH without compartment syndrome
 - Acute liver failure when acute metabolic derangements resolved
- Early EN in
 - ECMO, TBI, stroke, spinal cord injury, severe acute pancreatitis, GI surgery, prone, trauma...

ESPEN 4

- Blood glucose on admission and 4 hourly
- Insulin when glucose $>10\text{mmol/l}$
- Electrolytes daily and more regular in refeeding hypophosphataemia

Refeeding syndrome

- “Refeeding syndrome encompasses life-threatening acute **micronutrient** deficiencies, **fluid and electrolyte** imbalance, and disturbances of **organ** function and **metabolic regulation** that may result from over-rapid or unbalanced nutrition support.”

Refeeding syndrome

- Body mass index $<16 \text{ kg/m}^2$
- Unintentional weight loss $>15\%$ in the past three to six months
- Little or no nutritional intake for >10 days
- Low levels of potassium, phosphate, or magnesium before feeding.

Derangements

- Cardiac
- Pulmonary

- Hypophosphataemia
- Hypokalaemia
- Hypomagnesaemia and hypocalcaemia
- Hyperglycaemia

Treat

- Vitamin, trace, element replacement
- Monitoring
- Slow re-initiation of feed
- MDT input

Intestinal blood flow

- Increased permeability
- Potential role for selective gut decontamination

References

- British association of parenteral and enteral nutrition (BAPEN) website
- ESPEN guidance on nutrition in critical care
- BJA papers on critical care nutrition
- Dr Burch Nutrition/Gastroenterology lead at Coventry