Current perspectives in enteral and parenteral feeding

Julie Dowsett MSc FINDI
Outline of Talk

• Aims of nutrition support
• Who needs nutrition support?
• Enteral or parenteral?
• Refeeding syndrome
• Troubleshooting
Aims of nutrition support

- Preserve lean body mass
- Promote immune and wound healing responses
- Sustain vital organ function
- Minimise metabolic complications
‘first do no harm’

Avoid underfeeding        Avoid overfeeding
‘first do no harm’

Avoid underfeeding

- Malnutrition
- reduce immune function
- muscle breakdown
- compromise recovery

Avoid overfeeding
‘first do no harm’

Avoid underfeeding
- Malnutrition
- reduce immune function
- muscle breakdown
- compromise recovery

Avoid overfeeding
- Hyperglycaemia
  - phagocyte dysfunction
  - ↑ risk of infection
  - intracellular shifts of electrolytes
- Excessive CO$_2$ production
  - respiratory failure
  - prolonged vent requirements
- Organ system dysfunction
  - Hepatic (steatosis)
  - cardiac, resp, neurologic (refeeding)
Who needs nutrition support?

Those who are malnourished

- BMI < 18.5
- wt loss > 10% 3-6 months
- BMI < 20 wt loss > 5%
Who needs nutrition support?

Those who are malnourished

• BMI <18.5
• wt loss >10% 3-6 months
• BMI<20 wt loss >5%

Those at risk of malnutrition

• ↓ absorption
• ↑ needs due to disease
• Oral intake compromised for >5 days
## Interpretation of weight loss

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Significant weight loss</th>
<th>Severe weight loss</th>
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</thead>
<tbody>
<tr>
<td>One week</td>
<td>&lt;1-2%</td>
<td>&gt;2%</td>
</tr>
<tr>
<td>One month</td>
<td>5%</td>
<td>&gt;5%</td>
</tr>
<tr>
<td>3 months</td>
<td>7.5%</td>
<td>&gt;7.5%</td>
</tr>
<tr>
<td>6 months</td>
<td>10%</td>
<td>&gt;10%</td>
</tr>
</tbody>
</table>

Blackburn GL et al JPN 1977
Why enteral?

• Maintains gut integrity, prevents gut stasis and prevents stress ulceration.

• Compared to PN, EN has
  – superior metabolic handling of nutrients,
  – less infectious complications
  – significant cost savings.
Why enteral?

- Maintains gut integrity, prevents gut stasis and prevents stress ulceration.

- Compared to PN, EN has
  - superior metabolic handling of nutrients,
  - less infectious complications
  - significant cost savings.

If the gut works...USE IT!
EN contraindicated in

- Gut ischaemia or prolonged ileus, MOF
- GI fistula or obstruction distal to the feeding tube
- Inaccessible GIT or extensive reduction of absorptive surface
- Intractable vomiting
- Imminent death
Gastric emptying

Myoelectric Activity
Small bowel 4-8 hrs
Stomach 24 hours
Colon 2-5 days

- Dopamine
- Morphine
- Propofol
- Hyperglycaemia
- Endotoxin production in sepsis
Feeding routes

- PPN
- TPN
- Intravenous alimentation
- Nasogastric tube
- Gastrostomy tube
- Jejunostomy tube
- Nasoduodenal tube
- Nasojejunal tube
Patient Assessment ➔ Candidate for Nutrition Support
Patient Assessment ➔ Candidate for Nutrition Support

Contraindications to Enteral Nutrition?

No ➔ Enteral Nutrition
Patient Assessment → Candidate for Nutrition Support →

Contraindications to Enteral Nutrition?

No

Enteral Nutrition

Long term
Gastronomy
Jejunostomy

Short term
Nasogastric
Nasoduodenal
Nasojejunal
Contraindications to Enteral Nutrition?:

- No

Enteral Nutrition:

- GI Function:
  - Normal
    - Standard Formula
  - Long term: Gastronomy, Jejunostomy
  - Short term: Nasogastric, Nasoduodenal, Nasojejunal
Patient Assessment → Candidate for Nutrition Support

Contraindications to Enteral Nutrition?

No → Enteral Nutrition

Long term
Gastronomy
Jejunostomy

GI Function

Normal
Standard Formula

Compromised
Specialised formula

Short term
Nasogastric
Nasoduodenal
Nasojejunal
Candidate for Nutrition Support

Contraindications to Enteral Nutrition?

No

Enteral Nutrition

GI Function

Long term Gastronomy Jejunostomy

Short term Nasogastric Nasoduodenal Nasojejunal

Normal

Compromised

Standard Formula

Specialised formula

Feeding Tolerance

Adequate

Advance to oral feeding

Adequate

Consider oral feeding
Patient Assessment → Candidate for Nutrition Support

No

Enteral Nutrition

Contraindications to Enteral Nutrition?

GI Function

Normal

Compromised

GI Function

Standard Formula

Specialised formula

Feeding Tolerance

Adequate

Inadequate

Adequate

Advance to oral feeding

Supplementation with PN

Consider oral feeding

Progress to total enteral feeding
Patient Assessment → Candidate for Nutrition Support

Contraindications to Enteral Nutrition?

No → Enteral Nutrition

- Long term Gastronomy
- Jejunostomy

GI Function

- Normal
  - Standard Formula
    - Adequate: Advancing to oral feeding
    - Inadequate: Supplementation with PN
      - Supplementation with PN

- Compromised
  - Specialised formula
    - Adequate: Consider oral feeding
      - Consider oral feeding
      - Progress to total enteral feeding

Yes

Parenteral Nutrition

- Intestinal Obstruction
- Ileus
- Peritonitis
- Bowel Ischemia
- Intractable Vomiting
- and diarrhoea

- GI Function
  - Normal
  - Compromised

- Standard Formula
  - Specialised formula

- Adequate
  - Inadequate
  - Adequate

- Advance to oral feeding
  - Supplementation with PN
  - Consider oral feeding

- Parenteral Nutrition
  - Long term Gastronomy
  - Jejunostomy

- Short term
  - Nasogastric
  - Nasoduodenal
  - Nasojejunal

- Feeding Tolerance
Patient Assessment → Candidate for Nutrition Support →
Contraindications to Enteral Nutrition?

No → Enteral Nutrition
  - Normal GI Function
    - Standard Formula
      - Feeding Tolerance
        - Adequate → Advance to oral feeding
        - Inadequate → Supplementation with PN
  - Compromised GI Function
    - Specialised formula
      - Feeding Tolerance
        - Adequate → Consider oral feeding
        - Inadequate → Progress to total enteral feeding

Yes → Parenteral Nutrition
  - Short-term: No central access
    - Peripheral PN
  - Long-term: Gastronomy, Jejunostomy

Intestinal Obstruction
Ileus
Peritonitis
Bowel Ischemia
Intractable Vomiting and diarrhoea
Patient Assessment → Candidate for Nutrition Support

Contraindications to Enteral Nutrition?

No

Enteral Nutrition

GI Function

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Standard Formula

Adequate

Advance to oral feeding

Inadequate

Supplementation with PN

Progress to total enteral feeding

Compromised

Specialised formula

Adequate

Consider oral feeding

Parenteral Nutrition

Short term

No central access

Peripheral PN

Long term

Gastronomy

Jejunostomy

Anticipated long term need for concentrated PN solutions

Central PN

Short term

Nasogastric

Nasoduodenal

Nasojejunal

Intestinal Obstruction

Ileus

Peritonitis

Bowel Ischemia

Intractable Vomiting and diarrhoea
Patient Assessment ➔ Candidate for Nutrition Support

- Intestinal Obstruction
- Ileus
- Peritonitis
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- Intractable Vomiting and diarrhoea

**Contraindications to Enteral Nutrition?**

- No

**Enteral Nutrition**

- Normal GI Function
  - Standard Formula
  - Feeding Tolerance Adequate
    - Advance to oral feeding
  - Feeding Tolerance Inadequate
    - Supplementation with PN
    - Progress to total enteral feeding

- Compromised GI Function
  - Specialised formula
  - Feeding Tolerance Adequate
    - Consider oral feeding
  - Feeding Tolerance Inadequate
    - Supplementation with PN
    - Consider total enteral feeding with PN

**Parenteral Nutrition**

- Short –term No central access
  - Peripheral PN
  - Return of GI Function

- Anticipated long term need for concentrated PN solutions
  - Central PN

**GI Function**

- Normal
  - Standard Formula
  - Feeding Tolerance Adequate
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**Enteral Nutrition**

- GI Function
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  - Standard Formula
  - Specialised formula

  - Feeding Tolerance
    - Adequate
    - Inadequate

    - Advance to oral feeding
    - Supplementation with PN

  - Adequate
    - Consider oral feeding
    - Progress to total enteral feeding

**Parenteral Nutrition**

- Anticipated long term need for concentrated PN solutions

- Short –term
  - No central access

  - Peripheral PN
  - Central PN

- Return of GI Function

  - No
Patient Assessment → Candidate for Nutrition Support

Contraindications to Enteral Nutrition?

- Yes → Parenteral Nutrition
  - Anticipated long term need for concentrated PN solutions
  - Central PN
    - Return of GI Function
      - Yes
      - Oral intake indicated
      - Yes → Advance to oral feeding
      - No → Oral intake indicated
  - Peripheral PN

- No → Enteral Nutrition
  - GI Function
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      - Adequate Feeding Tolerance
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          - Yes: Advance to oral feeding
          - No: Consider oral feeding

Intestinal Obstruction
Ileus
Peritonitis
Bowel Ischemia
Intractable Vomiting and diarrhoea
Tube feeds

Nutricia
Abbott
Fresenius
<table>
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<tr>
<th>Feed</th>
<th>Indication</th>
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<tr>
<td>Standard +/- fibre</td>
<td>Non complicated enteral feed – 1.5-2 L/day</td>
</tr>
<tr>
<td>Higher energy density +/- fibre</td>
<td>Higher energy requirements, fluid restriction</td>
</tr>
<tr>
<td>Higher protein +/- fibre</td>
<td>Higher protein requirements</td>
</tr>
<tr>
<td>Elemental</td>
<td>Severe malabsorption / severe food allergies</td>
</tr>
<tr>
<td>Peptide</td>
<td>Malabsorption – less hyperosmolar than elemental</td>
</tr>
<tr>
<td>Renal</td>
<td>Low fluid, tailored vitamin and mineral profile</td>
</tr>
<tr>
<td>Diabetic</td>
<td>Low carbohydrate feed</td>
</tr>
<tr>
<td>ALI/ARDS</td>
<td>Higher fat, fish oil</td>
</tr>
<tr>
<td>Low sodium</td>
<td>For hypernatraemia when not due to dehydration</td>
</tr>
<tr>
<td>Immunonutrition</td>
<td>Conditionally essential AA, n3 FA etc</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.criticalcarenutrition.com">www.criticalcarenutrition.com</a></td>
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</table>
Probiotics?
Antibiotic associated diarrhoea AAD

- Diarrhoea common side effect of broad spectrum antibiotics in hospitals/ nursing homes
- frequency 5-60%.
- *Clostridium difficile* implicated in 15-25% of AAD
Probiotics & AAD

- 13/25 clinical trials → sig reduction of AAD vs control (RR= 0.43, p < 0.001)

- Most effective:
  - *Saccharomyces boulardii* (6 studies p<0.0001)
  - *Lactobacillus rhamnosus GG* (6 studies p<0.006)
  - Mixed probiotics (7 studies p<0.0001)

- Daily doses of > $10^{10}$ per day were associated with significant efficacy.

- Only *S boulardii* and *L casei* DN-114 001 were effective against *C. difficile*

L casei (Actimel) & C difficile

Patients given L casei DN114001 2 x /d. during & 1 wk after antibiotics

n=135  RDBPC study  mean age 74

Hickson M et al BMJ 2007; 335 : 80
Other considerations in EN

- Confirmation of ng placement
  National Patient Safety Agency Feb 05 [www.npsa.org.uk](http://www.npsa.org.uk)
- Hanging times, closed system, feed contamination
- Full strength feeds
- Management of dehydration
- Blue dye – never to be used!
  [http://www.fda.gov/ForIndustry/ColorAdditives/ColorAdditivesinSpecificProducts/InMedicalDevices/ucm142395.htm](http://www.fda.gov/ForIndustry/ColorAdditives/ColorAdditivesinSpecificProducts/InMedicalDevices/ucm142395.htm)
A Mixed Bag
An enquiry into the case of hospital patients receiving parenteral nutrition
Parenteral nutrition

- Amino acids
  - 1g nitrogen = 6.25g protein
  - Conditionally essential amino acids

- Fat
  - LCT soyabean/safflower oil
  - 0.5-1.2g/kg/day
  - MCT, MUFA, structured lipids

- Carbohydrate
  - Glucose – hypertonic → hyperglycaemia, thrombophlebitis
  - Fructose, sorbitol, xylitol → lactate production
  - Modify infusion rates, special attention in critical illness
Other considerations in PN

- Concurrent feeding/weaning
- Vitamin and mineral administration
- Specific guidelines re: labelling, storing, infusion, light protection
- Max handling loads
Refeeding syndrome

In starvation

Insulin ↓ and glucagon ↑

Glycolysis and gluconeogenesis ↑ glucose

Lipolysis → FFA and ketone bodies

Fat and muscle catabolism:

• loss of LBM
• water
• PO₄, Mg, K

Serum phosphate levels may remain normal
During refeeding

Glucose $\rightarrow$ ↑ insulin
Metabolism of fat $\rightarrow$ metabolism of carbohydrate
Insulin $\rightarrow$ move into cells of glucose, $PO_4$, Mg, K, and thiamin for anabolism

Leads to significant shifts in electrolytes and fluid.
Potential cardiac, resp, hepatic, renal, GI, neuromuscular and haematological consequences.
Recommendations

http://guidance.nice.org.uk/CG32

High risk of refeeding problems

• One or more of the following:
  • BMI less than 16 kg/m
  • unintentional weight loss greater than 15% within the last 3-6 months
  • little or no nutritional intake for more than 10 days
  • low levels of potassium, phosphate or magnesium prior to feeding

• Two or more of the following:
  • BMI less than 18.5 kg/m
  • unintentional weight loss greater than 10% within the last 3-6 months
  • little or no nutritional intake for more than 5 days
  • a history of alcohol abuse or drugs including insulin, chemotherapy, antacids or diuretics
High risk of refeeding problems

- Consider:
  - starting nutrition support at 10 kcal/kg/day max
  - increasing levels slowly
  - restoring circulatory volume and monitoring fluid balance and clinical status
  - providing thiamin and multivitamin/trace element supplement
  - providing extra potassium, phosphate and magnesium
Refeeding

- 25-35% of at risk populations
- Often under recognised and not treated
- Early identification
- Incidence in Ireland
Protocols

- Insertion of nasogastric tube
- Confirmation of placement of NG tube
- Enteral feeding protocol general ward
- Enteral feeding protocol ICU
- Post pyloric feeding protocol
- Post PEG protocol
- Parenteral nutrition protocol
- Weaning protocol from PN to EN

www.ispen.ie
Advancing standards of Nutrition Care

Disease-related malnutrition affects about 140,000 people in Ireland and costs at least €1.5 billion per year.

Founded with the support of the Irish Society of Gastroenterology (ISG), the Irish Nutrition and Dietetic Institute (INDI) and the Irish Section of the Nutrition Society, ISPEN is a society consisting of clinicians, dietitians, nutritionists and other health professionals from clinical practice, research and education. Together our aim is to combat malnutrition by optimising the nutritional management of patients in hospital and the community.

Free Membership

Register on our site and get free membership of ISPEN until the end of 2010.

Courses and Events

National and international courses and conferences in areas of nutrition support.

Join ISPEN

Get involved with ISPEN, discover what we have planned and see if you can help!

Latest News

'20 million people in EU with malnutrition' EU Parliament told
November 10, 2010

Increased incidence of Malnutrition
November 8, 2010

Latest Publication

A Picture of Ageing Research: Ireland, North and South
November 24, 2010
“That’s all Folks!”