Home enteral feeding:
Monitoring and long term management

Dr. Rebecca Burgell
Clinical Lead Alfred PEG service
The good news......

- Complications for PEG tubes are rare
  - All cause overall mortality (study of 10,952 PEG procedures)\(^1\) =
    - 7 day = 4%
    - 30 days = 14%

2. E Clarke et al. Gut 2015
The good news……

- Recent study examined the long-term mortality and morbidity in community managed patients post PEG insertion

  **Mortality**
  - 350 patients
  - No deaths and few complications directly related to PEG insertion
  - 3 months mortality = 16%
  - 12 months mortality = 35%
  - >12 months mortality = 54%

  cumulative

  **Morbidity**
  - 3 month = 10%
  - 12 months = 15%

  - 38% required treatment for an insertion site infection
  - 70% of these had more than one infection.
Early monitoring
Early monitoring

- Site
- Education / patient management of tube
- Drug review – methods of administration
- Bowel function
- Nutritional state
- Define nutritional goals
Early monitoring

- Commenced while the patient is still in hospital
  - Assess and monitor for potential complications
    - Aspiration pneumonia
    - Bleeding
    - Peritonitis
    - Infection
  - up to 58% of patients have evidence of a pneumoperitoneum post PEG.
    - Asymptomatic pneumoperitoneum should be treated conservatively

Early monitoring - Site

- Position of tube
  - number of centimeters at the skin
- Movement of the tube
Early monitoring – GI function

- Bowel function
  - Constipation
    - Can increase intolerance to feeding

- Diarrhoea
  - May require alteration of feed composition due to osmotic load
  - May require alteration of method of feed delivery (bolus vs. pump)

- Nausea / vomiting

- Abdominal pain
Early monitoring - Nutrition

- Baseline nutritional assessment
  - Height / weight / BMI
- Validated nutrition screen
Early monitoring - nutrition

- Indication for PEG
- Concurrent medical and/or surgical problems
- Age
- Metabolic demands
- Fluid requirements
- Baseline nutritional status
- Current addition dietary intake
Early monitoring - nutritional

- Risk of refeeding syndrome
  - one or more of the following:
    - BMI less than 16kg/m²
    - 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.
  - Or if the patient has two or more of the following:
    - BMI less than 18.5 kg/m²
    - 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
Early monitoring - Nutrition

- Monitoring for re-feeding syndrome
  - Day 1 = 2 x a day UEC. glucose, magnesium and phosphate
  - Day 2 – 6 = daily monitoring
  - Day 7 – 10 = weekly monitoring

Hofer et al. Nutrition 2013
ESPEN guidelines 2011
Early monitoring – patient education

- Feeding
- Psychosocial assessment
- Care of the stoma site
- Daily cleaning routine

- Do’s and Don’ts
- Trouble shooting
  - Tube dislodgement
  - Infection
Long term monitoring for Home Enteral Nutrition patients
Long-term monitoring

- Recommended that stable patients are reviewed every 3 – 6 months depending on goals of care\(^1\).

- Care should be provided by a multi-disciplinary team:
  - Registered nurse
  - Dietician
  - Medical Specialist
  - GP
  - Speech pathologist
  - Pharmacist

1. ACI and GENCA guidelines: 2014
Long term monitoring

1. Site
2. Device
3. Bowel function
4. Nutritional assessment
5. Psychosocial assessment
Site

- Hyper-granulation is the most common complication of PEG insertion occurring in up to $\frac{2}{3}$rd of patients

- Infection
  - occurs in ~ 40% of patients
  - Frequently recurrent

- Position

- Movement

ACI & GENCA guidelines 2014
Device

- No standardised time frame in which a device must be changed.
  - Wilson Cook = “PEG replacement is recommended every three months or at the discretion of the physician”.
  - Kimberly Clarke = “1-8 months”
Bowels

- Up to 70% of patients describe constipation
  - Many feeds are very low in fibre
  - Changing to a fiber enriched may be helpful

Ojo. O. Nutrients. 2015
Bowels

- Diarrhoea
  - Think constipation!!
  - Overflow diarrhoea is very common
  - Osmotic load of feed
  - Fiber content of feed\(^1\)
  - FODMAP content of feed\(^2\)

Body composition
Body composition

- Nutritional assessment
  1. “end-of-the-bed-o-gram”
  2. Weight / height / BMI
     - Does not give reliable measure of Fat mass and Fat free mass

Fig. 2. Body Mass Index (BMI) (kg/m²) (A) and fat-free mass (FFM) (kg) (B) (mean ± SD) measured by bioelectrical impedance analysis in 471 men at hospital admission and 619 sex and age-matched control subjects according to age (adapted from Kyle et al.36). BMI in patients at hospital admission remains statistically similar to BMI of healthy sex and aged paired-matched subjects, whereas FFM in patients is significantly lower than in healthy subjects in each age categories.
Body composition

- Body composition correlates with nutritional risk and clinical outcome
  - Length of stay
  - Clinical prognosis
  - Survival
  - Complication rates
Body composition

- Body composition correlates with nutritional risk and clinical outcome
  - Length of stay
  - Clinical prognosis
  - Survival
  - Complication rates

- Documents efficiency of nutrition support
- Allows optimization of nutritional support
Body composition

1. Anthropometry
2. Dual-energy X-ray Absorptiometry (DEXA)
3. Bioelectric impedance analysis (BIA)
4. Computerized tomography
**Fig. 1.** Mean values of body composition compartments in an healthy human subject of 70 kg (adapted with the permission of the publishers from Kyle et al.\textsuperscript{30}).
Body composition

1. Anthropometry
   - 4 skin fold measures
   - mid-arm muscle circumference

- Advantages
  - Cheap
  - Non invasive
  - No risk
  - Easily available

- Disadvantages
  - Poor reproducibility
  - Low sensitivity and specificity
  - Can be time consuming
  - Markedly effected by hydration status

Thibault et al. Clin Nutr 2012
Body composition

2. DEXA

- **Advantages**
  - Reference method of body composition
  - Reproducible
  - Provides measures of:
    - Fat Free Mass
    - Bone mineral
    - Fat mass

- **Disadvantages**
  - Expensive
  - Requires radiation
  - Low accessibility
  - Requires trained staff

Thibault et al. Clin Nutr 2012
Body composition

3. Bioelectrical impedance analysis (BIA)

- **Advantages**
  - Relatively inexpensive
  - Very easy to perform
  - Non invasive
  - Validated against DEXA (BMI 16 – 34)
  - Linear follow up in patients at extremes of BMI
  - No radiation
  - Easily available

- **Disadvantages**
  - Not validated in cancer patients
  - Not recommended in patients with abnormal hydration

Thibault et al. Clin Nutr 2012
<table>
<thead>
<tr>
<th>Principles</th>
<th>Single frequency BIA (SF-BIA)</th>
<th>Multi-frequency BIA (MF-BIA)</th>
<th>Segmental BIA</th>
<th>Bioimpedance spectroscopy (BIS)</th>
<th>Bioimpedance vector analysis (BIVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principles</td>
<td>Measurement of WB impedance at a single frequency: 50 kHz</td>
<td>Measurement of WB impedance at multiple frequencies: 1, 5, 50, 100, 200–500 kHz</td>
<td>Measurement of trunk and limbs impedance</td>
<td>Measurement of current path resistance at 0 and infinite frequencies to predict ECW and TBW</td>
<td>Measurement of the impedance vector which is the graphical plotting of resistance (R) and reactance (X) standardized for height</td>
</tr>
<tr>
<td>Advantages</td>
<td>Easy</td>
<td>Easy</td>
<td>Estimation of muscle volume and appendicular lean body mass</td>
<td>Accurate in healthy subjects</td>
<td>Stand-alone procedure not depending on equations or mathematical models</td>
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<tr>
<td></td>
<td>Non-invasive</td>
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<td></td>
<td>Low intersubject variability</td>
<td>Only affected by impedance measurement error</td>
</tr>
<tr>
<td></td>
<td>Very limited inter-observer variations</td>
<td>Direct evaluation of ECW, ICW and TBW</td>
<td></td>
<td>Optimal prediction of ECW and TBW</td>
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<tr>
<td></td>
<td>Relatively inexpensive</td>
<td>Measurement of phase angle</td>
<td></td>
<td></td>
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<td>Inconveniences</td>
<td>Inaccuracy if fluid changes</td>
<td>Use of empirical linear regression models</td>
<td>Need of standardization of the type of electrodes used</td>
<td>Mathematical modelling needing further validation in diseases for the evaluation of BCM</td>
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<tr>
<td></td>
<td>Use of empirical linear regression models</td>
<td>Poor reproducibility for frequencies &lt;5 kHz and &gt;200 kHz</td>
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<td></td>
<td>Not measuring directly TBW but the sum ECW + ICW</td>
<td>Inability to detect ECW and ICW changes in the elderly</td>
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<tr>
<td>Presumed indications</td>
<td>Assessment of FFM and FM in numerous clinical conditions</td>
<td>Assessment of body composition in patients with ECW increase (fluid retention, malnutrition)</td>
<td></td>
<td>Determination of fluid variations: further validation is needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prognosis value of phase angle</td>
<td>Determination of TBW for healthy, obese and chronic renal failure subjects</td>
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<td>Prognosis value of phase angle</td>
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</tbody>
</table>

BCM, body cell mass; ECW, extracellular water; FFM, fat-free mass; FM, fat mass; ICU, intensive care unit; ICW, intracellular water; TBW, total body water; WB, whole body.
Body composition

3. Computer tomography (CT)
   - Provides assessment of fat free mass and fat mass at the level of the L3 vertebrae

   - Advantages
     - Can be integrated into patients normal care

   - Disadvantages
     - Radiation exposure
     - Poor accessibility
     - Specific software required

Thibault et al. Clin Nutr 2012
Micronutrients & biochemistry
Micronutrients & trace elements

- 146 patients with either neurological indication or head and neck cancer were studied pre PEG
  - 122 (84%) had zinc deficiency
  - 31 (21%) had selenium deficiency
  - 16 (11%) had copper deficiency
  - 69 (47%) had iron deficiency
  - 6% had chromium deficiency

Micronutrient deficiency

- Feeds are nutritionally complete BUT:

- High rates of micronutrient deficiencies\(^1,2\)
  - i.e. out of 37 patients with PEG feeds
    - zinc deficient = 30 patients
    - Selenium deficient = 1 patient
    - Copper deficient = 2 patients

3. Changela et al. JPEN. 2012
Fig. 1. The serum concentrations of copper (a), zinc (b), selenium (c) and iron (d) in the PEJ (closed circles) and PEG group (open circles) from immediately before to 24 months after enteral feeding. The p-values for the two groups for copper concentration were 0.35 immediately before enteral feeding, <0.001 at 6 (*), 12 (†), and 24 (‡) months. There were no significant differences in zinc, selenium and iron concentrations throughout the observation period. The reference ranges of copper and zinc are 68–128 µg/dl and 65–110 µg/dl, respectively. The reference range of selenium is not available. The reference ranges of iron for males and females are 60–180 µg/dl and 43–66 µg/dl, respectively.
Micronutrient & trace elements

- Long term biochemical monitoring
  - Individualised depending on baseline status, risk factors and proportion of daily requirements administered via supplemental nutrition

- Special patient groups
  - IBD / short gut syndrome
    - increased likelihood of vitamin B12 or iron deficiency
  - Jejunal feeding
    - increased frequency of copper and iron deficiency

NICE guidelines 2012
Intestinal sites of nutrient absorption

- **ESOPHAGUS**
- **LIVER**
- **PANCREAS**
- **STOMACH**
- **DUODENUM**
- **JEJUNUM**
- **ILEUM**
- **CECUM and COLON**

**GALL BLADDER**

- **Bile**
- **Pancreatic enzymes**

**Water and sodium**

- **Amino acids, small peptides, monosaccharides, fatty acids, fat-soluble vitamins (A, E, D, K)**
- **Minerals (calcium, iron, others)**

**Disaccharides**

- **Water-soluble vitamins, zinc**

**Vitamin B12**

- **Potassium, short-chain fatty acids, vitamin K (also synthesized here)**

- **Bile salts**

- **Ileocecal valve**
Routine monitoring?
- Very little evidence
# Biochemistry

<table>
<thead>
<tr>
<th>Biochemical test</th>
<th>frequency</th>
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<tbody>
<tr>
<td>UEC</td>
<td>Daily initially then weekly</td>
</tr>
<tr>
<td>LFT/INR</td>
<td>Second daily then weekly</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Daily or twice daily initially</td>
</tr>
<tr>
<td>Glucose</td>
<td>twice initially then weekly</td>
</tr>
<tr>
<td>Phosphate</td>
<td>Daily or twice daily initially</td>
</tr>
<tr>
<td>Calcium, albumin</td>
<td>Daily initially</td>
</tr>
<tr>
<td>Zinc, copper</td>
<td>Baseline, monthly</td>
</tr>
<tr>
<td>selenium</td>
<td>baseline</td>
</tr>
<tr>
<td>FBE</td>
<td>weekly</td>
</tr>
<tr>
<td>Iron studies</td>
<td>Baseline, every 3 – 6 months</td>
</tr>
<tr>
<td>B12</td>
<td>Baseline, monthly</td>
</tr>
</tbody>
</table>

NICE guidelines 2012
Current practice...

- In stable patients who are not at particular risk of nutritional inadequacy
  - Baseline – full nutritional screen including selenium
  - 3 monthly – FBE, LFT, iron studies, UEC, Ca2+, Phosphate, magnesium
  - 6 monthly – as per 3 monthly review plus Zinc, Copper, vitamin D, Vitamin B12, fat soluble vitamins
How we structure our clinic...

- Patients are seen post PEG insertion
  - Assessment of site and device
  - Assessment of bowel function
  - Baseline nutrition assessment
    - Micronutrient and trace element screen
    - Body composition with BIA

- Patients reviewed every three months (or six monthly if stable and no high risk features)
  - Assessment of site and device
  - Assessment of bowel function

- Routine bloods three monthly with repeat trace elements, micronutrients and BIA every six months
  - If abnormalities detected more frequent monitoring undertaken until normalized