ESPEN-ESGE
HOW ENDOSCOPY MAY IMPROVE NUTRITION?

NUTRITION AND TECHNIQUES FOR ENTERAL ACCESS

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ENTERAL FEEDING OF PATIENTS

- Appropriateness of enteral feeding
- Timing of feeding
- Route and mode of enteral feeding
APPROPRIATENESS OF ENTERAL FEEDING

Absolute contraindications
- Mechanical obstruction (±)
- Fistula with distal obstruction (±)
- Insufficient functioning small bowel (±)
- Perforation (±)
- Fresh small bowel anastomosis (±)

Relative contraindications
- Intestinal dysmotility
- Severe diarrhoea or vomiting
CLINICIANS BELIEVE

1. that bowel sounds must be present before feedings can be started

2. that enteral nutrition is contraindicated in patients with abdominal surgery, gastrointestinal haemorrhage or pancreatitis

3. that feeding is not a treatment option and not an integral part of a comprehensive treatment plan on day 1 of admission at the ICU

While changing our belief, systems and feeding practices, gastrointestinal dysfunction will represent the major barrier to successful enteral nutrition

Heyland et al., Crit Care Med 1995; 23:1055-1060
ENTERAL FEEDING OF PATIENTS

- Appropriateness of enteral feeding
- Timing of feeding
- Route and mode of enteral feeding
## ENTERAL FEEDING

<table>
<thead>
<tr>
<th><strong>ROUTE</strong></th>
<th><em>nasogastric</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>nasoenteral</em></td>
</tr>
<tr>
<td></td>
<td><em>percutaneous gastric</em></td>
</tr>
<tr>
<td></td>
<td><em>percutaneous enteral</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MODE</strong></th>
<th><em>continuous</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>intermittent</em></td>
</tr>
<tr>
<td></td>
<td><em>bolus wise</em></td>
</tr>
<tr>
<td></td>
<td><em>gastric residuals</em></td>
</tr>
<tr>
<td></td>
<td><em>body position</em></td>
</tr>
</tbody>
</table>

| **FEEDING FORMULA** |
ACCESS FOR NUTRITIONAL SUPPORT

access for nutritional support can be challenging, costly, dangerous and even deadly

Factors affecting the decision of enteral access

- functioning of the gastrointestinal tract (absorption, motility)
- expected duration of nutritional support
  - short-term: nasogastric, nasoduodenal, nasojejunal tubes
  - long-term: gastrostomy, jejunostomy
- need of abdominal surgery: needle catheter jejunostomy
- available expertise and facilities
  - endoscopy
  - radiology
  - surgery
# NASOGASTRIC FEEDING TUBES

<table>
<thead>
<tr>
<th>Large bore (≥14 F)</th>
<th>Polyvinyl stiff material (1-wk exchange)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lower incidence of malpositioning</td>
</tr>
<tr>
<td></td>
<td>lower incidence of clogging</td>
</tr>
<tr>
<td></td>
<td>easier and more reliable check for gastric residuals (vented tube)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Small bore (8-12 F)</th>
<th>Silicone /polyurethane soft material (7-wk exchange)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>stylet to stiffen for insertion</td>
</tr>
<tr>
<td></td>
<td>more difficult to insert</td>
</tr>
<tr>
<td></td>
<td>higher incidence of malpositioning</td>
</tr>
<tr>
<td></td>
<td>higher incidence of clogging</td>
</tr>
<tr>
<td></td>
<td>inaccurate or impossible check for gastric residuals</td>
</tr>
</tbody>
</table>

## Check of proper placement
- absent coughing, gagging or hoarseness
- aspiration of fluid (pH, glucose, bilirubin)
- insufflation of 50 ml air
- plain abdominal X-ray
INSERTION OF NASODUODENAL / NASOJEJUNAL TUBES

- Gastric atony, gastric paresis
- Gastric outlet obstruction
- Gastro-oesophageal reflux and regurgitation
- Recurrent aspiration, (aspiration) pneumonia
- Acute pancreatitis

- NON-ENDOSCOPIC
- ENDOSCOPIC
TRANSPYLORIC FEEDING TUBE PLACEMENT

• **BLIND PLACEMENT**
  – spontaneous passage
  – weighted versus unweighted tubes
  – Bengmark tube
  – motility enhancing agents

• **BLIND ASSISTED PLACEMENT**
  – cork screwing
  – air insufflation
  – motility enhancing agents
  – Electromyogram-assisted placement
  – pH-assisted placement
  – Ultrasound-assisted placement
  – Magnetic-assisted placement
WEIGHTED NASOENTERIC FEEDING TUBES

<table>
<thead>
<tr>
<th></th>
<th>non-weighted</th>
<th>weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube stay days median</td>
<td>4.8</td>
<td>4.7</td>
</tr>
<tr>
<td>Unintended removal %</td>
<td>62</td>
<td>63</td>
</tr>
<tr>
<td>Transpyloric passage %</td>
<td>57</td>
<td>50</td>
</tr>
</tbody>
</table>

- do not prevent inadvertent displacement or removal
- do not facilitate transpyloric duodenal intubation

USE OF PROKINETIC DRUGS TO ASSIST IN PLACEMENT OF NASOENTERAL FEEDING TUBES

7 RCT; 5 with metoclopramide; 2 with erythromycin
- significantly more tubes in post-pyloric position with prokinetics (59% versus 35%)
INSERTION OF NASODUODENAL / NASOJEJUNAL TUBES

✓ Gastric atony, gastric paresis
✓ Gastric outlet obstruction
✓ Gastro-oesophageal reflux and regurgitation
✓ Recurrent aspiration, (aspiration) pneumonia
✓ Acute pancreatitis

• NON-ENDOSCOPIC
• ENDOSCOPIC
INDICATIONS FOR ENDOSCOPIC POSITIONING OF FEEDING TUBES

- Transnasal route failed or impossible
- Requirement of proximal drainage / decompression and feasibility of distal feeding
- Necessity of transpyloric intraduodenal or deep intrajejunal feeding
INDICATIONS FOR ENDOSCOPIC POSITIONING OF FEEDING TUBES

- Transnasal route failed or impossible
  - neurologic dysphagia, coma
  - oesophageal stenosis, gastric (outlet) obstruction, hiatal hernia
  - artificial ventilation

- Requirement of proximal drainage or decompression and feasibility of distal feeding
  - oesophageal or gastric perforation
  - oesophageal or biliodigestive fistula
  - postoperative anastomotic oedema or anastomotic leakage

- Necessity of transpyloric intraduodenal or deep intrajejunal feeding
  - gastric atony, gastroparesis
  - recurrent aspiration, aspiration pneumonia
  - artificial ventilation
  - pancreatitis
ENDOSCOPIC POSITIONING OF FEEDING TUBES

1. ENDOSCOPIC INSERTION OF GUIDE-WIRE, REMOVAL OF ENDOSCOPE AND INSERTION OF FEEDING TUBE OVER GUIDE-WIRE
   - Single feeding tube
   - Double suction-and-feeding tube
ENDOSCOPIC POSITIONING OF FEEDING TUBES

1. ENDOSCOPIC INSERTION OF GUIDE-WIRE, REMOVAL OF ENDOSCOPE AND INSERTION OF FEEDING TUBE OVER GUIDE-WIRE
   - Single feeding tube
   - Double suction-and-feeding tube

2. ENDOSCOPIC INSERTION OF FEEDING TUBE
   - The drag and pull technique
   - Introduction of feeding tube through instrumentation channel and advancing under direct view
ENDOSCOPIC POSITIONING OF FEEDING TUBES
TRANSNASAL ENDOSCOPY
INSERTION OF GUIDEWIRE, REMOVAL OF ENDOSCOPE AND INSERTION OF FEEDING TUBE OVER GUIDE-WIRE
### MORBIDITY OF NASOGASTRIC/ENTERAL FEEDING TUBES

1. **Insertion of tube**
   - mucosal trauma; malpositioning

2. **Presence of tube**
   - * nasal irritation, septum decubitus
   - * rhinorrhea; sinusitis; parotic gland enlargement; otitis media;
   - * ulcer/ perforation of larynx, pharynx; oesophagus; stomach
   - * oesophageal stricture
   - * tracheo-oesophageal fistula
   - * gastro-oesophageal reflux, aspiration; aspiration pneumonia
   - * gastric linear ulcers

3. **Tube-related**
   - tube degradation
   - tube clogging
   - inadvertent tube removal
<table>
<thead>
<tr>
<th>Tube length</th>
<th>105 cm</th>
<th>125 cm</th>
<th>145 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube length inserted cm beyond D-J junction</td>
<td>7.6</td>
<td>13.1</td>
<td>19.9</td>
</tr>
<tr>
<td>N</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Duration of procedure min.</td>
<td>13.8</td>
<td>13.1</td>
<td>12.8</td>
</tr>
<tr>
<td>Location of tube no.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximally to D-J junction</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Within D-J junction</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Distally to D-J junction</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Duration of tube span days</td>
<td>10.5</td>
<td>8.3</td>
<td>13.1</td>
</tr>
<tr>
<td>Electively removed</td>
<td>4</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Pulled out by patient</td>
<td>4</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Inadvertent removal nurse</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Unexplained fall-out</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Blockage</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Mathus-Vliegen Gastroint Endosc 1993;39:537-42**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>68%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10%</td>
</tr>
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</table>
4-MONTH TUBE STAY
INDICATIONS FOR A GASTROSTOMY

- Nutritional support
  - Long-term enteral feeding (> 4 weeks)
  - Supplemental feeding

- Gastrointestinal decompression

- Combined nutritional support and gastrointestinal decompression
PERCUTANEOUS ENDOSCOPIC GASTROSTOMY (PEG)

Ponsky-Gauderer
pull; pull-on-string; per os pull gastrostomy

Russell
introducer; push; poke; percutaneous push gastrostomy

PERCUTANEOUS RADIOLOGIC GASTROSTOMY (PRG)

Russell
introducer; push; poke; percutaneous push gastrostomy
PEG CONTRAINDICATIONS
pull gastrostomy procedure

- **Absolute**
  - Interposed organs
  - Absent transillumination
  - Gastric mucosal abnormalities
  - Coagulation disturbances

- **Relative**
  - Oesophageal obstruction / oesophageal cancer
  - Oesophagotracheal fistula
  - Oropharyngeal / systemic infection (Candida, MRSA, VRE)
PEG CONTRAINDICATIONS
pull gastrostomy procedure

- **Absolute**
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  - Oropharyngeal / systemic infection (Candida, MRSA, VRE)
PEG CONTRAINdications
fistulous track formation

- **Absolute**
  - Peritoneal dialysis
  - Peritoneovenous shunt
  - Ventriculoperitoneal shunt
  - Albumin level \( \leq 25 \text{ g/l} \)
  - Absent wall apposition

- **Relative**
  - Malignant ascites
  - Peritonitis carcinomatosa
  - Immunosuppression
  - Corticosteroid treatment
PEG CONTRAINDICATIONS
fistulous track formation

- **Absolute**
  - Peritoneal dialysis
  - Ventriculoperitoneal shunt
  - Peritoneovenous shunt
  - Albumin level ≤ 25 g/l
  - Absent wall apposition

- **Relative**
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  - Peritonitis carcinomatosa
  - Immunosuppression
  - Corticosteroid treatment

  → broad systemic antibiotic 4 days
  → T-fasteners / push PEG
  → T-fasteners

{ T-fasteners }
PERCUTANEOUS ENDOSCOPIC GASTROSTOMY (PEG)

Ponsky-Gauderer
pull; pull-on-string; per os pull gastrostomy

Russell
introducer; push; poke; percutaneous push gastrostomy

PERCUTANEOUS RADIOLOGIC GASTROSTOMY (PRG)

Russell
introducer; push; poke; percutaneous push gastrostomy
introducer / push / poke
PEG / PRG

T-fasteners

balloon / Russell / button
gastric position

intestinal position
COMPLICATIONS OF PEG PROCEDURE OR PEG USE

MAJOR COMPLICATIONS

- Aspiration
- Perforation (early; late)
- Peritonitis (early; late)
- Gastrocolocutaneous fistula
- Haemorrhage
- Premature removal of the gastrostomy tube
- Tube migration through the gastric wall
- Necrotising fasciitis
- Tumour implantation at PEG stoma
COMPLICATIONS OF PEG PROCEDURE OR PEG USE

MINOR COMPLICATIONS

- Peristomal wound infection
- Tube obstruction or fragmentation
- Leakage around gastrostomy tube
- Tube migration into the small bowel

MISCELLANEOUS COMPLICATIONS

- Pneumoperitoneum
- Subcutaneous emphysema
LIFETIME IN DAYS OF THE FIRST PEG/JPEG TUBE IN PATIENTS WITH TUBES FOR EXTENDED (>28 D) PERIODS

<table>
<thead>
<tr>
<th>Reason</th>
<th>N</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removed not needed anymore</td>
<td>32</td>
<td>88</td>
<td>34-851</td>
</tr>
<tr>
<td>Removed because of death</td>
<td>108</td>
<td>161</td>
<td>33-1254</td>
</tr>
<tr>
<td>Removed because of dysfunction</td>
<td>43</td>
<td>349</td>
<td>35-1123</td>
</tr>
<tr>
<td>Exchanged for a button</td>
<td>9</td>
<td>287</td>
<td>67-1397</td>
</tr>
<tr>
<td>In situ</td>
<td>52</td>
<td>495</td>
<td>162-1732</td>
</tr>
</tbody>
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Mathus-Vliegen & Koning Gastrointest Endosc 1999
TRANSPYLORIC DUODENAL/ JEJUNAL FEEDING BY NASOENTERAL TUBE OR PERCUTANEOUS ENDOSCOPIC OR RADIOLOGIC GASTROJEJUNOSTOMY

- Gastric atony, gastric paresis
- Gastric outlet obstruction
- Gastro-oesophageal reflux and regurgitation
- Recurrent aspiration, (aspiration) pneumonia
- Acute pancreatitis
ASPIRATION PNEUMONIA

DISTINGUISH BETWEEN
- Oropharyngeal aspiration
- Gastric aspiration
- Tube feeding aspiration

PRECAUTIONS
- elevation of head of bed during food administration
- regular assessment of feeding tube tip location
- regular assessment of feeding tolerance by measuring gastric residuals
- minimal use of narcotics
- adaptation of feeding regimens (continuous / bolus feeds)

HIGH RISK PATIENTS
- prokinetic agents
- small bowel feeding tubes at / below ligament of Treitz
  - gastric reflux of food with location in duodenum 20.9%
  - with location at Treitz ligament 11.9%
  - with location in proximal jejumum 3.6%
# POST-PYLORIC FEEDING AND ASPIRATION (PNEUMONIA)

<table>
<thead>
<tr>
<th>Author</th>
<th>Location</th>
<th>Placement</th>
<th>Pneumonia %</th>
<th>gastric</th>
<th>postpyloric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montecalvo ’92</td>
<td>G 19 J 19</td>
<td>Endoscopy</td>
<td>31.6</td>
<td>21.1</td>
<td>ns</td>
</tr>
<tr>
<td>Strong ’92</td>
<td>G 17 D 16</td>
<td>Radiology</td>
<td>31.3</td>
<td>40.0</td>
<td>ns</td>
</tr>
<tr>
<td>Kortbeek ’99</td>
<td>G 43 D 37</td>
<td>Radiology</td>
<td>42.0</td>
<td>27.0</td>
<td>ns</td>
</tr>
<tr>
<td>Kearns ’00</td>
<td>G 23 D 21</td>
<td>Blind</td>
<td>13.0</td>
<td>19.0</td>
<td>ns</td>
</tr>
<tr>
<td>Esparza ’01</td>
<td>G 27 D 24</td>
<td>Radiology/prokinetics/EMG</td>
<td>7.0</td>
<td>13.0</td>
<td>ns</td>
</tr>
</tbody>
</table>

*With gastric drainage*

<table>
<thead>
<tr>
<th>Author</th>
<th>Location</th>
<th>Placement</th>
<th>Pneumonia %</th>
<th>gastric</th>
<th>postpyloric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heyland ’01</td>
<td>G 21 D 18</td>
<td>Blind, endoscopy</td>
<td>39.8</td>
<td>24.9</td>
<td>ss*</td>
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<tr>
<td>Davies ’02</td>
<td>G 34 D 39</td>
<td>Endoscopy</td>
<td>3.0</td>
<td>6.0</td>
<td>ns•</td>
</tr>
<tr>
<td>Montejo ’02</td>
<td>G 51 J 50</td>
<td>Endoscopy, radiology, blind</td>
<td>40.0</td>
<td>32.0</td>
<td>ns^</td>
</tr>
</tbody>
</table>

* = GE reflux; # = microaspiration; • and ^ = significantly less gastric retention with feeding postpyloric
**PERCUTANEOUS ENDOSCOPIC JEJUNOSTOMY**

<table>
<thead>
<tr>
<th></th>
<th>Kaplan n=23</th>
<th>DiSario n=20</th>
<th>DeLegge n=18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration pneumonia</td>
<td>43%</td>
<td>33%</td>
<td>100%</td>
</tr>
<tr>
<td>decreased with</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mortality of aspiration</td>
<td>9%</td>
<td>40%</td>
<td>0%</td>
</tr>
<tr>
<td>Catheter failure</td>
<td>84%</td>
<td>70%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Kaplan et al. Gastrointest Endosc 1989;35:403  
DiSario et al. Gastrointest Endosc 1990;36:257  
DeLegge et al. JPEN 1995;19:239
Enteral nutrition is almost always possible by adapting nutrition and tubes to particular disease states. Endoscopy may help to improve nutrition by early, immediate and successful positioning of tubes in difficult cases.

Nasogastric feeding tubes are the first choice, but when a period of > 4 weeks is foreseen, the percutaneous endoscopic gastrostomy is a safe and more elegant procedure, even in severely debilitated and critically ill patients.

In contrast to feeding tubes, which clog easily or are removed inadvertently, most gastrostomy tubes remain present and patent for the duration of feeding without tube material degradation.

There is still a debate concerning the need of postpyloric feeding in patients at risk for aspiration.