Complications and Monitoring of Enteral Nutrition

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Complications of EN

- Gastrointestinal
- Aspiration
- Tube related
- Metabolic
Complications of EN

<table>
<thead>
<tr>
<th>Problem</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance</td>
<td>10-40 %</td>
</tr>
<tr>
<td>Tube malposition</td>
<td>up to 50 %</td>
</tr>
<tr>
<td>Nausea / Vomiting</td>
<td>10-15 %</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>25-60 %</td>
</tr>
<tr>
<td>Infections</td>
<td>rare</td>
</tr>
<tr>
<td>Metabolic complications</td>
<td>very rare</td>
</tr>
<tr>
<td>Aspiration</td>
<td>??</td>
</tr>
</tbody>
</table>

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Reasons for diarrhoea during EN

- Bolus application
- High delivery rate
- High osmolality
- Bacterial contamination of the formula diet
- Inadequate low temperature of the formula diet
- Gastrointestinal infections
- Malabsorption
Work up of diarrhoea during EN

- Switch to continuous application
- Decrease the delivery rate (temporarily)
- Avoid bacterial contamination (change drip line daily, deliver formulae within 6-10 hours)
- Review prescriptions (prokinetics, antibiotics, antacids, atropin etc.)
- Exclude GI infections (stool culture, clostridium difficile)
- In malabsorption change to low molecular diets
# Problems of EN during 1929 days in ICU patients

Adam S, Batson S; Intensive Care Med 1997; 23: 261-266

<table>
<thead>
<tr>
<th>Problem</th>
<th>days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric reflux</td>
<td>191</td>
</tr>
<tr>
<td>Nausea / Vomiting</td>
<td>112</td>
</tr>
<tr>
<td>Meteorism</td>
<td>62</td>
</tr>
<tr>
<td>Pain</td>
<td>20</td>
</tr>
<tr>
<td>GI-Bleeding</td>
<td>17</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>16</td>
</tr>
<tr>
<td>Tube malposition</td>
<td>37</td>
</tr>
<tr>
<td>Tube occlusion</td>
<td>12</td>
</tr>
</tbody>
</table>
Risk factors for aspiration during EN

- Neurological impairment
- Diminished gag reflexes
- Impaired gastric emptying
- Supine position
- Incompetent lower oesophageal sphincter

Aspiration pneumonia
Reasons for impaired gastric emptying during EN

- **Preexisting diseases:**
  - Diabetes mellitus
  - Vagotomy
  - Systemic scleroderma
  - Myopathies

- **Acute disease related:**
  - Pain and stress
  - Pancreatitis
  - Spinal cord injury
  - Extensive trauma, abdominal surgery, burn injuries

- **Medication:**
  - Opioids
  - Anticholinergics
  - Erythromycin
Prevention of aspiration during EN

In ICU patients measure > GI reflux periodically: interruption of infusion, gastric drainage

Pathologic reflux: > 200 ml/ 6 h or > 1l/d

- Measure reflux, adjust delivery rate
- Prever a semi-recumbent position (30 – 45 °)
- Prever nasojejunal tube feeding
Malposition of nasogastric tubes

CT-scan of intracranial tube malposition in a patient with severe head injury
Malposition of nasogastric tubes

Incorrectly placed nasogastric tube into the right lung
# Tube occlusion

## Prevention of tube occlusion

- **Flushing with water (≥ 40 ml)** before and after feeding
- **Flushing all 4-6 hours during feeding when fine bore tubes are used**
- **Avoid precipitation of medication by sufficient flushing**

## Treatment of tube occlusion

- **Application of warm water, sodium bicarbonate, pancreatic enzymes**
- **Avoid high pressure or other violence**
- **Tube replacement**

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Tube rupture after application of high pressure for dislodging

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Complications of percutaneous endoscopic gastrostomy (PEG)

- **Pain**: 5-7%
- **Bleeding**: 0.6 – 1.2%
- **Local wound infection**: 3 - 30%
- **Sepsis**: < 1%
- **Perforation**: very rare

Local wound infection
Prevention of local wound infection after PEG insertion

Use antibiotics preinterventionally especially in Patients with impaired immune function or cancer

30 min before PEG insertion: 3rd generation cephalosporine or broad spectrum penicillin
The Refeeding Syndrome


First described in Far East prisoners of war after the second world war.

Starting to eat again after a period of prolonged starvation seemed to precipitate cardiac failure.
The Refeeding Syndrome – who is at risk?

- Severe malnutrition
  - High age
  - Cancer
- Patients with AIDS
- Chronic alcohol abuse
- Malabsorption
- Gastric bypass
- Severe weight loss in obesity

Albrecht Dürer, „Mother“ 1514
The Refeeding Syndrome - findings

- Hypophosphataemia
- Hypokalaemia
- Hypomagnesaemia
- Thiamin (and other vitamin) deficiency
- Fluid retention

Neuromuscular dysfunction
Hypoventilation
Lactic acidosis
Cardiac arrhythmia
Congestive cardiac failure
Monitoring of enteral nutrition

- Feed administration
- Fluid balance
- Laboratory tests
- Nutritional status
- Functional status
Conclusion

- Most complications of EN are the results of application errors
- Certain diseases are associated with specific complications (e.g. aspiration in neurological impairment)
- Acceptance of EN can be enhanced by adequate monitoring and adjustment
- Careful monitoring is especially important in intensive care and in elderly patients and neurological disorders
- In severely malnourished patients excessive food intake must be avoided and careful monitoring is mandatory to avoid the life-threatening refeeding syndrome