Meeting nutritional needs of acute care patients

Feeding acute pancreatitis patients

J. Luttikhold (NL)
LEARNING OBJECTIVES

Know the pathophysiology of acute pancreatitis and induced changes in gastrointestinal physiology

Know the different feeding routes and feeds and their indications, based on the severity of the acute pancreatitis and the accessibility of the digestive tract
SUMMARY

Enteral nutrition (EN) is superior to parenteral nutrition (PN)

Probiotic should not be administered

The use of supplements are not recommended

Early enteral feeding is safe

Nasogastric tube feeding seems safe when tolerated
Jejunal feeding is recommended in delayed gastric emptying

EN should not be supplemented by PN

On-demand feeding strategy is advised, and when patients do not tolerate an oral diet after 72 hours, EN can be started
ANATOMIC VARIATIONS

PANCREAS DIVISUM

- Caput
- Corpus & Cauda
- Obduction: 5%
- Pancreatitis e.c.i.: 25%
ANATOMIC VARIATIONS
PANCREAS ANNULARE

incidence: 1:20,000
FYSIOLOGY

Endocrine  Insulin secretion
Buffer
Exocrine
FYSIOLOGY

Endocrine
Buffer
Secretion of bicarbonate
Exocrine
neutralizes gastric acid
pH increase from 4 to 8
FYSIOLOGY

Endocrine
Buffer
Exocrine

Digestion of protein
Digestion of carbohydrates
Digestion of fats
FYSIOLOGY

Endocrine
Buffer

Exocrine

Digestion of protein
Digestion of carbohydrates
Digestion of fats

trypsinogen → trypsin
enteropeptidase

trypsinogen → trypsin
FYSIOLOGY

Endocrine

Buffer

Exocrine

Digestion of protein

Digestion of carbohydrates

Digestion of fats

Trypsinogen → Trypsin → Chymotrypsin → Chymotrypsinogen
FYSIOLOGY

Endocrine
Buffer
Exocrine

Digestion of protein
Digestion of carbohydrates
Digestion of fats

amylase
FYSIOLOGY

Endocrine

Buffer

Exocrine

Digestion of protein
Digestion of carbohydrates
Digestion of fats

lipase
cholesterolesterase
phospholipase
The exact mechanism is not completely known

Co-localization of zymogen and lysosome

Premature activation of trypsin induces cell death

Cytosolic cathepsin B induces apoptosis or necrosis, leading to cell death

Pancreatitis is a sterile infection which can be complicated by a bacterial superinfection
ETIOLOGY

- Gallstones: 40%
- Alcohol: 20%
- Unknown: 30%
- Other: 10%

Diagram:
- Gallstones
- Ethanol
- ERCP
- Idiopathic
- Drugs
- Autoimmune pancreatitis
- Anatomic obstruction
- Pancreatic injury
- TNF-α and IL-1
- Inflammatory cascade (IL-2, IL-6, IL-8, IL-10, bradykinin, PAF)
- Systemic inflammatory response syndrome
- Multi-organ dysfunction syndrome
- Death
BILIARY PANCREATITIS

5%

Symptomatic gallstones
Compression by gallstones in the common bile duct

Obstruction by edema

Obstruction by a gallstone in the ampulla hepatopancreatica

↑ pressure in pancreas

Stasis of pancreatic juice

Reflux of gall
↑ pressure in pancreas
stasis of pancreatic juice
reflux of gall

autodigestion
ALCOHOLIC PANCREATITIS

5%

Alcohol abuses
Protein plugs, atrophy & fibrosis

Acetaldehyde & free fatty acids

Metabolism of alcohol in the pancreas
CURRENT TREATMENT

DO’S!
Aggressive hydration
Analgesia
Anti-emetics
Post-pyloric enteral feeds
Treatment of hyperglycemia
Consider ERCP in gallstone

DON’T’S!
Routine prophylactic antibiotics
Fine needle aspiration
Drainage of peripancreatic fluid collections
Parenteral nutrition
NPO policy

In theory...

EN, either orally or by tube, has a negative impact on the progression of the disease due to stimulation of exocrine pancreatic secretion and the consequent worsening of the autodigestive processes of the pancreas.
ESPEN GUIDELINES 2006
ENTERAL NUTRITION (EN)

In mild acute pancreatitis EN has no positive impact on the course of disease and is only recommended in patients who cannot consume normal food after 5–7 days.

In severe necrotising pancreatitis EN is indicated and should be supplemented by parenteral nutrition if needed.

In the majority of patients continuous EN with peptide-based formulae is possible.

The jejunal route is recommended if gastric feeding is not tolerated.
PN is indicated when oral intake is inadequate for 5–7 days. Substrate metabolism in severe AP is similar to that in severe sepsis or trauma. Parenteral amino acids, glucose and lipid infusion do not affect pancreatic secretion and function.

PN is indicated only in those patients who are unable to tolerate targeted requirements by the enteral route.

When PN is administered, particular attention should be given to avoid overfeeding.

When PN is indicated, a parenteral glutamine supplementation should be considered.
NEW DEVELOPMENTS

Enteral nutrition or parenteral nutrition  
[COCHRANE REVIEW 2010]

Probiotics  
[PROPATRIA TRIAL 2008]

Early versus on demand enteral feeding  
[PYTHON TRIAL 2014]
Enteral versus parenteral nutrition for acute pancreatitis (Review)

Al-Omran M, AlBalawi ZH, Tashkandi MF, Al-Ansary LA
OBJECTIVE

To compare the effect of TPN versus EN on mortality, morbidity and length of hospital stay in patients with acute pancreatitis

8 trials
# RESULTS

Figure 3. Forest plot of comparison: Enteral versus parenteral nutrition for acute pancreatitis, outcome: 1.1 Mortality.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Favours EN Events</th>
<th>Favours EN Total</th>
<th>TPN Events</th>
<th>TPN Total</th>
<th>Weight</th>
<th>Risk Ratio M-H, Fixed, 95% CI</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kalfarentzos 1997</td>
<td>1</td>
<td>18</td>
<td>2</td>
<td>20</td>
<td>6.6%</td>
<td>0.56 [0.05, 5.62]</td>
<td>1997</td>
</tr>
<tr>
<td>McClave 1997</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>16</td>
<td>Not estimable</td>
<td>1997</td>
<td></td>
</tr>
<tr>
<td>Olah 2002</td>
<td>2</td>
<td>41</td>
<td>4</td>
<td>48</td>
<td>12.8%</td>
<td>0.59 [0.11, 3.03]</td>
<td>2002</td>
</tr>
<tr>
<td>Abou-Assi 2002</td>
<td>8</td>
<td>26</td>
<td>6</td>
<td>27</td>
<td>20.5%</td>
<td>1.38 [0.56, 3.44]</td>
<td>2002</td>
</tr>
<tr>
<td>Gupta 2003</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>9</td>
<td>Not estimable</td>
<td>2003</td>
<td></td>
</tr>
<tr>
<td>Louie 2005</td>
<td>0</td>
<td>10</td>
<td>3</td>
<td>18</td>
<td>8.9%</td>
<td>0.25 [0.01, 4.35]</td>
<td>2005</td>
</tr>
<tr>
<td>Petrov 2006</td>
<td>2</td>
<td>35</td>
<td>12</td>
<td>34</td>
<td>42.4%</td>
<td>0.16 [0.04, 0.67]</td>
<td>2006</td>
</tr>
<tr>
<td>Casas 2007</td>
<td>0</td>
<td>11</td>
<td>2</td>
<td>11</td>
<td>8.7%</td>
<td>0.20 [0.01, 3.74]</td>
<td>2007</td>
</tr>
</tbody>
</table>

Total (95% CI) 165 183 100.0% 0.50 [0.28, 0.91]
Total events 13 29

Heterogeneity: Chi² = 7.84, df = 5 (P = 0.17); I² = 36%
Test for overall effect: Z = 2.28 (P = 0.02)
CONCLUSION

EN significantly reduced mortality, multiple organ failure, systemic infections, and the need for operative interventions compared to those who received TPN.

In addition, there was a trend towards a reduction in length of hospital stay.

These data suggest that EN should be considered the standard of care for patients with acute pancreatitis requiring nutritional support.
BRAINSTORM

How can we prevent infection?

Prophylactic antibiotics are not effective
Wittau et al – Scan J Gastroenterol 2010

Two alternative options…
- Prophylactic probiotics?
- Early enteral feeding?
In theory…

Enteral administration of probiotics could prevent infectious complications

Certain strains of probiotic bacteria might prevent infectious complications by reducing small-bowel bacterial overgrowth, restoring gastrointestinal barrier function, and modulating the immune system.
**PROPATERIA: RESULTS**

<table>
<thead>
<tr>
<th>Primary endpoint</th>
<th>Probiotics (N=152)</th>
<th>Placebo (N=144)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any infectious complication*</td>
<td>46 (30%)</td>
<td>41 (28%)</td>
<td>0.80</td>
</tr>
<tr>
<td>Infected necrosis</td>
<td>21 (14%)</td>
<td>14 (10%)</td>
<td>0.29</td>
</tr>
<tr>
<td>Bacteraemia</td>
<td>33 (22%)</td>
<td>22 (15%)</td>
<td>0.18</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>24 (16%)</td>
<td>16 (11%)</td>
<td>0.31</td>
</tr>
<tr>
<td>Urosepsis</td>
<td>1 (0.7%)</td>
<td>2 (1%)</td>
<td>0.61</td>
</tr>
<tr>
<td>Infected ascites</td>
<td>4 (3%)</td>
<td>0 (0%)</td>
<td>0.12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary endpoint</th>
<th>Probiotics (N=152)</th>
<th>Placebo (N=144)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowel ischaemia</td>
<td>9 (6%)</td>
<td>0 (0%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Mortality</td>
<td>24 (16%)</td>
<td>9 (6%)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

DSMB: early termination of the study
CONCLUSION

Probiotic prophylaxis with this combination of probiotic strains was associated with an increased risk of mortality.

Probiotic prophylaxis should therefore not be administered in this category of patients.
DISCUSSION

Higher proportion of patients with organ failure before randomisation as well as a greater proportion of patients with more than 30% pancreatic parenchymal necrosis than in the placebo group.

The administration of 10 billion probiotic bacteria per day on top of enteral nutrition might have even further increased local oxygen demand, with a combined deleterious effect on an already critically reduced bloodflow.

A second possible explanation could be that the presence of probiotics caused local inflammation at the mucosal level.
In theory...

The trophic effect of early enteral feeding would stabilize the integrity of the gut mucosa, reducing inflammation and improving the outcome.
<table>
<thead>
<tr>
<th>STUDY PROTOCOL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
</tr>
<tr>
<td></td>
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<tr>
<td><strong>Comparisson</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
</tr>
</tbody>
</table>
RESULTS

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Early Enteral Nutrition (N = 101)</th>
<th>Nutrition On Demand (N = 104)</th>
<th>Risk Ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary composite end point:</strong> Infection or death – no. (%)</td>
<td>30 (30)</td>
<td>28 (27)</td>
<td>1.07 (0.79 – 1.45)</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>Individual components</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infections – no. (%)</td>
<td>25 (25)</td>
<td>27 (26)</td>
<td>0.97 (0.70 – 1.34)</td>
<td>0.87</td>
</tr>
<tr>
<td>Infected pancreatic necrosis</td>
<td>9 (9)</td>
<td>15 (14)</td>
<td>0.74 (0.43 – 1.26)</td>
<td>0.28</td>
</tr>
<tr>
<td>Bacteraemia</td>
<td>17 (17)</td>
<td>18 (17)</td>
<td>0.98 (0.68 – 1.43)</td>
<td>1.00</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>12 (12)</td>
<td>13 (13)</td>
<td>0.97 (0.63 – 1.50)</td>
<td>0.84</td>
</tr>
<tr>
<td>Death – no. (%)</td>
<td>11 (11)</td>
<td>7 (7)</td>
<td>1.27 (0.85 – 1.89)</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Need for tube feeding in nutrition ‘on demand’: 31%

Patients can be fed orally ‘on demand’
CONCLUSION

No superiority of early nasoenteric tube feeding, as compared with an oral diet after 72 hours, in reducing the rate of infection or death in patients with acute pancreatitis.

These findings do not support clinical guidelines recommending the early start of nasoenteric tube feeding in all patients with severe acute pancreatitis in order to reduce the risks of infection and death.
IMMUNONUTRITION

Immunomodulating supplements
- Arginine, glutamine
- Omega 3 fatty acids
- Purines and pyrimidines

No significant differences
- Length of hospital stay
- Infectious complications
- Mortality

Positive effect on intestinal integrity and possibly on bacterial translocation (mainly in pigs and dogs)

Zou XP, et al. JPEN;34(5):554
NEW DEVELOPMENTS IN FEEDING THE ICU PATIENT

Early high protein intake is associated with lower mortality and energy overfeeding is associated with lower mortality in non-septic mechanically ventilated critically ill patients

Peter JM Weij{{1,2,3}, Wilhelmus GPM Looijaa{1}, Albertus H Govers{1}, and Heleen M Oudemans-van Straaten{1,4}

Permissive underfeeding in ICU patients: a randomised controlled trial

Yaseen M Arabi, Hani M Tamim, Salim H Kahoul, and Riette Bruining

Am J Clin Nutr 2011;93:569–77
COMPLICATIONS OF ENTERAL NUTRITION
COAGULATION OF EN

Casein dominant enteral nutrition coagulates in an acidic environment as the stomach.

This may lead to gastrointestinal obstruction.

Less accessible for protein digestion and absorption.

Critically ill patients with an impaired digestion should be considered candidates for EN with non-coagulating proteins or hydrolysed proteins.
Early High Protein Intake Without Energy Overfeeding in Critically Ill Patients

Wilhelmus GPM. Looijaard¹, Nadine Denneman¹, Bo Broens¹,
Peter JM. Weijs¹, ², Heleen M. Oudemans-van Straaten¹

¹Department of Adult Intensive Care Medicine, ²Department of Nutrition and Dietetics
VU University Medical Center, Amsterdam, Netherlands

Conclusion

This high-protein EN formula containing hydrolysed whey protein is well tolerated and enables clinicians to achieve a high protein target early during ICU stay, without exceeding the defined energy target.
SUMMARY

Enteral nutrition is superior to parenteral nutrition

Probiotic should not be administered

Early enteral feeding is safe

Nasogastric tube feeding seems safe when tolerated
Jejunal feeding is recommended in delayed gastric emptying

EN should not be supplemented by PN

In patients with predicted severe acute pancreatitis an on-demand feeding strategy is advised and when patients do not tolerate an oral diet after 72 hours, enteral nutrition can be started

The use of supplements, both parenteral as enteral, are not recommended
EXTRA TAKE HOME MESSAGE

Avoid casein dominant EN in ICU patients

High protein low energy for ICU patients
CONSIDERATIONS

Do we really need to feed patients with acute pancreatitis differently from critically ill?

From NPO to PN to PN to on-demand...
PROTOCOL ICU VUMC

1.2 – 1.5 gram/kg bodyweight before admission

Day 1: 0.5L EN
Day 2: 0.75L EN
Day 3: 1L EN
Day 4: target 80% energy need and 1.5 g/kg protein
Day 7: target 100%

After ... days the acute phase with endogene engery production has passed, in the recovery phase – nobody knows when that is – patient require more
App store: Luttikhold
www.thesisapps.com/luttikhold