Challenges to Diagnosing Enteral Feeding Intolerance

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HOSPITAL MALNUTRITION: FREQUENCY AND COST OF CARE

1 in 3

Annual direct medical costs of disease-associated malnutrition in the US

>15.5 billion

The Malnutrition Paradox

GI Intolerance is the “BRAKE” on Effective *Enteral Nutrition Delivery

*Enteral Nutrition is Oral Nutrition Supplement or Tube feeding
Goals and Objectives

• Define enteral nutrition intolerance
• Analyze the clinical reasons for interrupting enteral nutrition
• Determine the relevancy of data supporting the identified “reasons” for interrupting enteral nutrition
Tolerate Definition

Verb
Allow the existence, occurrence, or practice of (something that one does not necessarily like or agree with) without interference.
  • accept or endure (someone or something unpleasant or disliked) with forbearance.
  • be capable of continued subjection to (a drug, toxin, or environmental condition) without adverse reaction

Synonyms
Allow, permit, authorize, sanction, condone, agree to, accede to, approve of
Enteral Feeding “ Interruption ”

* Derived From ICU Studies

- Nausea and vomiting (OS)
- High gastric residuals (O)
- Diarrhea (O)
- Abdominal pain (S)
- Bowel sounds (O)
- Bloating (S)
- Abdominal distention (O)

O – Objective  S – Subjective
Nursing Survey of Enteral Intolerance

- Survey of 2298 US Nurses on GI Intolerance
- 42% University-Based Nurses
- 6 Assessment Tools Used to Determine GI Intolerance
  - Gastric Residual Volume (97.1%)
  - Abdominal Distention (88.5%)
  - Vomiting (86%)
  - Bowel Sounds (79.7%)
  - Nausea (79.6%)
  - Abdominal Discomfort (79.3%)

  64% use all 6 assessment tools
  5% use 1 assessment tool

Gastric Residuals:
- Enteral Nutrition Held:
  - < 200 ml – 24.9%
  - > 200 ml - 36.5%
  - > 250 ml – 21.4%
  - > 500ml – 12.6%

- ASPEN Guideline:
  - Gastric residual volumes in the range of 200-500 mL should raise concern and lead to the implementation of measures to reduce risk of aspiration, but automatic cessation of feeding should not occur for GRVs < 500 mL.

Hospital-Wide Study

<table>
<thead>
<tr>
<th>Rx</th>
<th>Total</th>
<th>ICU</th>
<th>Non-ICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-emetic</td>
<td>47%</td>
<td>46%</td>
<td>48%</td>
</tr>
<tr>
<td>Pro-kinetic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-diarrheal</td>
<td>3%</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>Anti-Motility</td>
<td>2%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Combo</td>
<td>5%</td>
<td>4%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Decrease TF Rate

Hold TF < 24 Hours

Stop TF

Change NG to NJ

Change to PN

Wang et al: JPEN 2015

Figure 3. Kaplan-Meier curves showing proportion of patients not achieving goal rate as a function of time in days after commencement of feeding. ETFI, enteral tube feeding intolerance.
Gastrointestinal Gut Secretions
Even When NPO

Somewhere between 3-5 L of secretions are made per day.
Enteral Feeding Intolerance

“Biomarkers”

- Nausea and Vomiting
- Diarrhea
- Presence of Bowel Sounds
- Abdominal Distention
- Bloating
- Gastric Residual Volumes
Nausea and Vomiting

There Are No Data Evaluating the Use of Nausea and Vomiting For Determination of Enteral Nutrition Tolerance
Differential Diagnosis of Nausea and Vomiting

The Differential Diagnosis Needs to be Vetted in a Step-Wise; Time Efficient Manner
Diarrhea

Limited Data Investigating its Use as a Meaningful Tool for Clinicians
Diarrhea With Enteral Nutrition

The Differential Diagnosis Needs to be Vetted in a Step-Wise; Time Efficient Manner
Diarrhea
Definition Difficulty

Survey for Factors That Influence Diagnosis of Diarrhea to Interrupt Tube Feedings
• 8 Dietitians
• 7 Stroke Nurses
• 7 ICU Nurses
• 11 GI Physicians

Agreement of 3 Risk Factors
• Stool Frequency – 43%
• Stool Consistency – 37%
• Stool Quantity – 20%

Whelan et al; J Human Nutr Dietet 2003

The Term Diarrhea Has More Than 33 Definitions in the Literature
Bernard et al; Nutr Clin Pract 2004
Impact of Fiber and Probiotics on Diarrhea with Enteral Nutrition

Both Fiber and Probiotics Have Not Consistently Been Shown to Improve Diarrhea
Bowel Sounds and Enteral Nutrition

- Limited Data Investigating its Use as a Meaningful Tool for Clinicians
Bowel Sounds

- Changes of GI motility following abdominal surgery first noted on X-ray in the 1890’s
- One century ago the practice of listening for bowel sounds was initiated (nurses)
- Belief that bowel sounds correlate with bowel function
Bowel Sounds Survey
Hospital-Based

- RN (19) and (54) NP/PA surveyed
- How long do you listen for bowel sounds?

- Madsen et al; Am J Nurs 2005
Correlation of Bowel Sounds With Bowel Function

- 38 patients following colon surgery
  - Early fed group – 5.2 day LOS
  - Traditional fed group – 8 day LOS
  - Ileus group – 10.6 day length of stay

- *Neither bowel sounds nor flatus production were a good indicator of oral tolerance.*

- Bufo et al; Dis Colon Rectum 1994
Abdominal Distention and Bloating

Limited Data Investigating its Use as a Meaningful Tool for Clinicians
Intraluminal Gas

- Total volume at any one time is 100 – 200 ml
- Complicated process of gas input and output
- Gas in GI tract
  - Swallowing
  - Chemical reactions
  - Fermentation
  - Diffusion (from blood)
Abdominal Distention and Bloating

• 30% of people in a US survey had a regular feeling of bloating
• 75% of these people quantified their bloating as severe

• Thompson et al; Functional Intestinal Disorders, 2000
Pathophysiology of Bloating/Distention
Four Factors

• Subjective sensation
• Objective girth changes (distention)
• ? Dependent on volume of intra-abdominal contents
• Abdominal wall muscular activity

Objective Abdominal Distention May Not Correlate to Symptoms of Boating
<table>
<thead>
<tr>
<th>Study</th>
<th>Device</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poynard et al</td>
<td>Tape measure</td>
<td>No</td>
</tr>
<tr>
<td>Maxton et al</td>
<td>Tape measure</td>
<td>Yes</td>
</tr>
<tr>
<td>Sullivan et al</td>
<td>CT scan</td>
<td>Yes</td>
</tr>
<tr>
<td>Lea et al</td>
<td>Plethysmography</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Poynard et al, J Neurogastro Motility 2013
Maxton et al; Gut 1991
Sullivan et al; ISRN Gastro, 2012
# Do Patients With Bloating Have More Intestinal Gas?

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lasser et al</td>
<td>Washout</td>
<td>N</td>
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<tr>
<td>Serra et al</td>
<td>Washout</td>
<td>N</td>
</tr>
<tr>
<td>Calderella et al</td>
<td>Washout</td>
<td>N</td>
</tr>
<tr>
<td>Chami et al</td>
<td>X-ray</td>
<td>Y</td>
</tr>
<tr>
<td>Koide et al</td>
<td>X-ray</td>
<td>Y</td>
</tr>
<tr>
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Lasser et al; NEJM 1975  
Serra et al: Gastro 1998  
Calderella et al, Gastro 2000  
Chami et al; Am J Gastro 1991  
Poynard et al, J Neurogastro Motility 2013  
Maxton et al; Gut 1991
Abdominal Wall

• Shape of abdominal wall influenced by the vertebral column, anterolateral muscles, diaphragm and pelvis.

• Even without volume changes in the gut, subtle changes in body position can create new abdominal distention.
Gastric Residual Volume
Gastric Residual Volume

- The Impact of Measuring GRV on Aspiration Events Has been Studied in the ICU
- The Impact of GRV on Aspiration Events on the Hospital Floor Has Not Been Studied
- The Impact of Checking GRV on the Ability to Deliver Nutrition on the Hospital Floor Has Not Been Studied
### Table 2. Randomized Controlled Trials on the Use of Monitoring GRV.

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>GRV</th>
<th>Type/Size of Tube</th>
<th>Method*</th>
<th>Primary End Point*</th>
<th>Main Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRV higher vs lower thresholds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Pinilla et al, 2001⁶⁸</td>
<td>96</td>
<td>&gt;150 mL vs &gt;250 mL⁷</td>
<td>NG: n = 41, 10 Fr: n = 25</td>
<td>Aspiration every 4 h</td>
<td>Frequency of GI intolerance: high GRV, emesis, or diarrhea</td>
<td>No statistical difference, trend of improved EN, and reduced time to reach goal rate with GRV &gt;250 mL⁶⁸</td>
</tr>
<tr>
<td>McClave et al, 2005⁶⁹</td>
<td>40</td>
<td>&gt;200 mL vs &gt;400 mL⁷</td>
<td>NG: n = 21, 12 Fr: n = 19, 8 Fr: n = 2</td>
<td>NA</td>
<td>Frequency of regurgitation/aspiration</td>
<td>No statistical difference</td>
</tr>
<tr>
<td>Montejó et al, 2010⁷⁰</td>
<td>329</td>
<td>&gt;200 mL vs &gt;500 mL⁷</td>
<td>NG: &lt;8 Fr: 3%, 8 Fr: 6%, 10 Fr: 14.8%, 12 Fr: 34%, &gt;12 Fr: 42%</td>
<td>Gravity drainage for 10 min or aspiration (50-mL syringe)⁹</td>
<td>Diet volume ratio⁸</td>
<td>First week of ICU stay: mean EN volume ratio 200 mL: 84.5%, 500 mL: 88.2% (P = .0002). No between-group difference after second week</td>
</tr>
<tr>
<td>Monitoring vs not monitoring GRV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reignier et al, 2013⁷¹</td>
<td>449</td>
<td>&gt;250 mL vs no GRV measurement</td>
<td>NG: no size reported</td>
<td>Aspiration (50-mL syringe)</td>
<td>VAP</td>
<td>No difference</td>
</tr>
<tr>
<td>Regular vs variable time interval of monitoring GRV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Williams et al, 2014⁷²</td>
<td>357</td>
<td></td>
<td>NG: 12–14 Fr²</td>
<td>Aspiration</td>
<td>Number of gastric tube aspirations per day</td>
<td>More tube aspirations per day in the control group (5.4 vs 3.4 in the intervention group, P &lt; .001)</td>
</tr>
</tbody>
</table>

Gastric Residual Volume

### Table 3. Current Guideline Recommendations on the Use of GRV Monitoring.

<table>
<thead>
<tr>
<th>Guidelines*</th>
<th>DGEM 2013**</th>
<th>CCPG 2013¹</th>
<th>A.S.P.E.N. 2009² **and 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRV</td>
<td>For patients, especially those who are admitted with a medical diagnosis, units that can safely handle a concept of not monitoring GRV should do so, thereby reducing nurses' workload. EN delivery rate should be modified in the event of vomiting (A; strong consensus).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>There are insufficient data to make a recommendation for not checking GRVs and for establishing a specific gastric residual volume threshold.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Holding EN for gastric residual volumes &lt;500 mL in the absence of other signs of intolerance should be avoided (grade B).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>In (abdomino)surgical patients, GRV should be measured regularly (every 4–6 hours), and a threshold of 200 mL should be considered to adjust the EN delivery rate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on 1 level 2 study, a gastric residual volume of either 250 or 500 mL (or somewhere in between) is acceptable as a strategy to optimize delivery of EN in critically ill patients.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*No specific information on the use of GRV monitoring in the currently available ESPEN (European Society for Clinical Nutrition and Metabolism) guidelines on EN in intensive care medicine.²⁴⁷

A.S.P.E.N., American Society for Parenteral and Enteral Nutrition; CCPG, Canadian Clinical Practice Guidelines; DGEM, German Society for Nutritional Medicine; EN, enteral nutrition; GRV, gastric residual volume.
Tube Feeding
The Rate “Truth”

- 10 cc/hr = 1 cc every 6 minutes
- 20 cc/hr = 1 cc every 3 minutes
- 30 cc/hr = 1 cc every 2 minutes
Going Forward

- **Content of Enteral Formulations**
  - Alternative Osmolarities
  - Alternative Fats
  - Small Peptide
  - Low Carbohydrate
  - Plant-Based, Non-GMO

### Intolerance Tool

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nausea or Vomiting</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Regurgitation</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Bloating</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

*Mild – 2x or less per week and generally does not interfere with enteral nutrition or oral supplement intake*
*Moderate – 3x-7x episodes/week and intermittently interferes with delivery of enteral nutrition or oral supplement intake*
*Severe – 7x or greater per week and usually interferes with delivery of enteral nutrition or oral supplement intake*
Conclusion

- Enteral tolerance is under the microscope by clinicians
- We have more reasons to stop EN than we do to initiate it
- Bowel sounds and gastric residual volume are poor biomarkers of enteral intolerance
- There is limited data validating the importance of abdominal distention, bloating, nausea and diarrhea as a biomarker of GI intolerance
- We need a standardized tool to diagnose enteral feeding intolerance