Nutrition in the Surgical Trauma ICU: why and how?

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Disclosure

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Objectives

After this presentation participants should be able to:

1) Describe the importance of early enteral immunonutrition after trauma

2) List different aspects of formulations which support tolerance of immunonutrition

3) Discuss evidence showing the benefits of volume-based feeding (VBF) of surgical trauma patients
South Carolina Trauma Centers
Mechanism of Injury

Penetrating 15%

Blunt 84%
TRAUMA REGISTRY PATIENTS

- 2013: 2495
- 2014: 2642
- 2015: 2679
- 2016: 3087
- 2017: 3443
- 2018: 3370
Surgical Trauma Intensive Care Unit

- 18 bed STICU
- Average age 25 – 45
- Approximately 600 admissions per year
Significant Polytrauma

- Head injury
- Spine injury
- Pulmonary contusions
- Rib fractures
- ARDS
- Open abdomens
- Solid organ injury
- Pelvic fractures

...and on and on and on and on
Physiology of Trauma

• Significantly increased catabolic state

• Significant fluid requirements

• Significant inflammation leading to capillary leak

Fighting the Lethal Triad

- Acidosis
- Hypothermia
- Hypercoagulability
Fighting (impending) Infection

• Trauma patients don’t come in septic (unlike MICU) – we allow it
  – Central lines
  – Foley catheters
  – Hardware
  – Contaminated wounds
  – etc...etc...etc
Trimodal Distribution of Trauma Deaths

Adapted from The American College of Surgeons Trauma Evaluation And Management (TEAM) Course
Where we started: 2011

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation of Enteral Feeds</td>
<td>Day 4</td>
</tr>
<tr>
<td>Variation in reaching 80% of goal</td>
<td>Day 9-never</td>
</tr>
<tr>
<td>Meeting caloric needs</td>
<td>49%</td>
</tr>
<tr>
<td>Meeting protein needs</td>
<td>44%</td>
</tr>
</tbody>
</table>

- No formal enteral nutrition feeding protocol
- Using whole protein formula and protein boluses
We knew better:

- 2009 Critical Care Nutrition Guidelines:
  - Supported early enteral nutrition
  - Emphasis on volume or calories

  So we knew where we needed to get to, but didn’t know how to safely get there...

So let’s figure this out

• *When* to feed?

• *What* to feed (and how much)?

• *How* to *safely* and effectively accomplish it?
WHEN TO FEED?
Early and Enteral!

• 2016 Critical Care Nutrition Guidelines
  – Suggest the use of EN over PN in critically ill
  – Early enteral nutrition (EEN) recommended to start within 24-48 hrs
  – More emphasis on protein adequacy

McClave SA et al. JPEN 2016;40(2):159-211.
Early Enteral Access- in the ER

- Critical
- Any patient who can’t feed himself/herself
- No exceptions
- Sump port open
Benefits of EEN

Early vs. Delayed or No EN

Meta-analysis of 21 RCTs; 13 reporting on infection

- Infectious Morbidity
  - RR = 0.74; 95% CI, 0.58–0.93; p= .01)

- Mortality
  - RR = 0.70; 95% CI, 0.49–1.00; p= .05)

McClave SA et al. JPEN 2016;40(2):159-211.
WHAT TO FEED?
Different Types of Nutrition

• Standard Nutrition
  – Benefit derived primarily from protein and calories
  – Addresses malnutrition by improving nutritional status
  – ≥ 2-4 weeks duration required

• Surgical Immunonutrition
  – Benefit is not derived primarily from protein and calories
  – Additive ingredients modulate immune, vascular and inflammatory responses.
  – Meets distinct nutritional requirements of the surgery and trauma patient to improve recovery
  – Shorter term (5-10 day perioperative period) duration

## Critical Care Nutrition Guidelines – Immunonutrition: Surgery and Trauma

<table>
<thead>
<tr>
<th>Population</th>
<th>Peri-op SICU</th>
<th>Post-op SICU</th>
<th>Severe Trauma</th>
<th>Traumatic Brain Injury (TBI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guideline</td>
<td>Immune-modulating formulas containing arginine with other agents (including EPA, DHA, glutamine, nucleic acid) are suggested (E2,O3)</td>
<td>Immune-modulating formulas containing arginine and fish oils are suggested for routine use (O3)</td>
<td>Immune-modulating formulas containing arginine and fish oils are suggested (M1b)</td>
<td>Immune-modulating formulas containing arginine with other agents (including EPA, DHA, glutamine, nucleic acid) are suggested based on expert consensus (E2, M2b)</td>
</tr>
</tbody>
</table>

Evidence Based Outcomes: Drover et al Meta-Analysis

- 35 RCTs in major elective surgery (n= 3438)
  - 25/35 studies in elective GI surgery

- Evaluated pre-, peri- and post-operative use of arginine-supplemented immunonutrition (IM) on outcomes:

**Primary Outcome**
Infectious complications reduced by 41%
(p<0.00001)

**Secondary Outcomes**
Hospital LOS reduced
WMD 2.38 days (p<0.00001)

Mortality: No change

**Various sub-analyses**

Sub-analyses
Arginine-Supplemented IM Formulas on Infection

- Only Arg-n3-nucleotide formula showed statistically significant benefit when compared with other arginine supplemented (IM) formulas (p<0.0001)

Arginine Simplified

Depleted Arginine → T-Cell Dysfunction → Decreased nitric oxide production/ Decreased tissue oxygenation → Risk of INFECTION

Risk of WOUND BREAKDOWN

Arginine is Not the Whole Story

• n-3 fatty acids
  – EPA and DHA from Fish Oil
    • Minimize inflammatory response by decreasing production of inflammatory mediators
    • Increase immune response by enhancing lymphocyte function
    • **Arginase expression may be modified by the type of fatty acid**

Prevalence of n-3 PUFA Deficiency

• Study subjects were US residents

• 655 adults screened

• 89% were n-3 PUFA deficient (OS <6.1%)
  – Omega-Score (OS) = blood EPA + DHA + DPA

The Role of Nucleotides

- Building blocks for DNA and RNA
- Indispensable in stressed states
- Essential for rapidly replicating cells to help support immune function

Tolerance Matters

- **Objective:** Determine if there was a difference in the incidence of diarrhea between two formulas used in the SICU.

- **Methods:**
  - Consecutive 3 month periods of retrospective chart review
  - Formula A = IM - more hydrolyzed**; 50% MCT (n=52)
  - Formula B= IM - less hydrolyzed**; 20% MCT (n=61)

- **Results:**
  - No statistical difference in the following: number of C. difficile tests ordered or the number of antibiotics, laxatives or antimotility agents received

**Data on file. Multiple batches tested by an external laboratory using the SDS-PAGE (sodium dodecyl sulfate-polyacrylamide gel electrophoresis) method. Intact protein defined as having a weight of 19 kDa (kilodaltons) or greater.**

Rumberger L et al. 2014  Clinical Nutrition Week, Abstract 1835637
Tolerance Matters: Results

<table>
<thead>
<tr>
<th>IM Formula</th>
<th>Days of diarrhea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formula A</strong> - More Hydrolyzed; 50% MCT</td>
<td>1.42</td>
</tr>
<tr>
<td><strong>Formula B</strong> - Less Hydrolyzed; 20% MCT</td>
<td>4.25</td>
</tr>
</tbody>
</table>

- Need for rectal tube to manage diarrhea:

  - **Formula A**: 12% Yes, 88% No
  - **Formula B**: 30% Yes, 70% No

Rumberger L et al. 2014 Clinical Nutrition Week, Abstract 1835637
HOW TO SAFELY FEED?
STICU Patients are High Risk:

Nutritional Risk Screening (NRS-2002)

- Trauma patients not typically malnourished on admission
- Injury puts them at high risk

<table>
<thead>
<tr>
<th>Severity of disease (~stress metabolism)</th>
<th>Normal nutritional requirements</th>
<th>Hip fracture</th>
<th>Chronic patients, in particular with acute complications: cirrhosis, COPD, chronic hemodialysis, diabetes, oncology</th>
<th>Major abdominal surgery, Stroke, Severe pneumonia, hematologic malignancy</th>
<th>Head injury, Bone marrow transplantation, Intensive care patients (APACHE 10+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent Score 0</td>
<td>Normal nutritional requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild Score 1</td>
<td>Hip fracture</td>
<td>Chronic patients, in particular with acute complications: cirrhosis, COPD, chronic hemodialysis, diabetes, oncology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate Score 2</td>
<td>Major abdominal surgery, Stroke, Severe pneumonia, hematologic malignancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe Score 3</td>
<td>Head injury, Bone marrow transplantation, Intensive care patients (APACHE 10+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NUTRIC Score

- Pre-existing malnutrition and Severity of Illness

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&lt;50</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>50 - &lt;75</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>≥ 75</td>
<td>2</td>
</tr>
<tr>
<td>APACHE II</td>
<td>&lt;15</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>15 - &lt;20</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>20 - &lt;28</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>≥ 28</td>
<td>3</td>
</tr>
<tr>
<td>SOFA</td>
<td>&lt;6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>6 - &lt;10</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>≥ 10</td>
<td>2</td>
</tr>
<tr>
<td>Number of Co-morbidities</td>
<td>0-1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>≥ 2</td>
<td>1</td>
</tr>
<tr>
<td>Days from hospital to ICU admission</td>
<td>0 - &lt; 1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>≥ 1</td>
<td>1</td>
</tr>
</tbody>
</table>

High Score = 5-9

- Associated with worse clinical outcomes (mortality, ventilation)
- These patients are most likely to benefit from aggressive nutrition

Adapted from Table 2, Kondrup J. Clin Nutr 2003

ASPEN Adult Nutrition Support Core Curr, 3rd Ed. 2017; Chapter 24 Trauma, Surgery and Burns: 36-56.

Heyland DK et al. Crit Care 2011
High Protein Needs

- After major injury, 90-130 g/d protein are lost in wound exudate and urine x first 10 days
- 20%-25% of calories (1.5-2.0 g/kg)
  - Morbidly obese (2.0-2.5 g/kg)
  - CRRT (2-2.5 g/kg)

1. SICU Patients achieving ≥80% of protein target achieve a 33% reduction in stay.
2. Achieving >80% of prescribed protein intake is associated with reduced mortality in critically ill patients.

ASPN Adult Nutrition Support Core Curr, 3rd Ed. 2017; Chapter 24 Trauma, Surgery and Burns: 36-56.
Calorie Needs

• 20-40 kcal/kg/day (my practice)

• Penn State Equation

\[ RMR = \text{Mifflin}(0.96) + V_E(31) + T_{max}(167) - 6212 \]

• Indirect calorimetry on qualifying patients

Feeding Challenges in the STICU

- Multiple surgeries requiring NPO status at midnight
- “ortho add-on diet”
- Open abdomens
- Abdominal pathologies/gastric intolerance
Step One: Nutrition Bundle

1. Assess patients on admission to the ICU for nutrition risk, and calculate both energy and protein requirements to determine goals of nutrition therapy.

2. Initiate EN within 24-48 hours following the onset of critical illness and admission to the ICU and increase to goals over the first week of ICU stay.

3. Take steps as needed to Reduce Risk of aspiration or improve tolerance to gastric feeding (use prokinetic agent, continuous infusion, chlorhexidine mouthwash, elevate the head of bed and divert level of feeding in the GI tract).

4. Implement enteral feeding Protocols with institution-specific strategies to promote delivery of EN.

5. Do not use gastric residual volumes as part of routine care to monitor ICU patients on EN.

6. Start PN early when EN is not feasible or sufficient in high risk or poorly nourished patients.

History of Volume Based Feeding → PEP uP

Enhanced Protein-Energy Provision via the Enteral Route Feeding Protocol

• 24-hour volume based EN protocol
  – Start with semi-elemental, peptide-based formula
  – Day #1- Start at 25 ml/hr; add motility agent and protein powder
  – Day #2- Change rate to provide 24 hr target volume (not to exceed 150 mL/hr)
  – Tolerate higher GRV threshold (300 mL or more)

• Initial work included only 4 trauma patients and did not utilize peptide-based immunonutrition

PEP uP Results:

- Multi-Center Trial
- PEP uP
  - 60.1% of prescribed energy
- Control
  - 49.1% of prescribed energy


Keep NPO
Trophic feeds only
Progress to hourly goal rate
Start at rate determined by 24 hr volume goal
<table>
<thead>
<tr>
<th>Traditional Method</th>
<th>PEP uP Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Delayed start times</td>
<td>• Starting within 24- 48 hours of hemodynamic stability</td>
</tr>
<tr>
<td>• Varying tube feed formulas</td>
<td>• Specific high protein, semi-elemental, immunonutrition formula, with supplemental arginine, n-3 fatty acids and nucleotides used within the intensive care unit</td>
</tr>
<tr>
<td>• Start at 10 ml/hr and increase by 10 ml per MD instructions</td>
<td>• Start at 25 ml/hr and increase straight to goal on day 2 of initiating enteral feeds.</td>
</tr>
<tr>
<td>• Held for procedures and then restarted at lower rates before titrating to goal</td>
<td>• Volume/day provided so nursing can catch up for time missed</td>
</tr>
<tr>
<td>• Held for prolonged periods of time due to differing intolerance definitions</td>
<td>• Defined intolerance and “what to do” guidelines for nursing</td>
</tr>
<tr>
<td>• No formalized protocol or guidelines</td>
<td>• Formalized protocol</td>
</tr>
</tbody>
</table>
Surgical Trauma ICU Orders:

Tube Feedings: Patient to start within 24 to 48 hours of admission to the ICU AND after proper resuscitation (Lactate < 2.0 and pressor support < 12 mcg/min levophed mEq). Formula is peptide-based immunonutrition with supplemental arginine, n-3 fatty acids and nucleotides.

- Continuous
  - 10 ml/hr Initial Rate, Surgical Trauma ICU. TROPHIC rate DO NOT advance without MD order.
- Continuous
  - 25 ml/hr Initial Rate, Surgical Trauma ICU. Day #1 Rate to start at 25 ml/hr
- Continuous
  - Surgical Trauma ICU. Day #2 at 6 am advance to weight based volume: < 50 kg = 700 ml/24 hr, 50.1-65 kg = 900 ml/24 hr, 65.1-80 kg = 1100 ml/24 hr, > 80 kg = 1300 ml/24 hr
- Continuous
  - Surgical Trauma ICU. Day #2 at 6 am advance to goal based volume: 960 ml/day, 1080 ml/day, 1200 ml/day, 1320 ml/day, 1440 ml/day, 1560 ml/day.

Nursing Orders:
- Do Not Check Gastric Residuals
  - Check Gastric Residuals if patient demonstrates signs of intolerance such as nausea, vomiting, distention, or abdominal pain. If greater than 500 ml, decrease to 25 ml/hr and notify MD.
Gastric Residual Volume (GRV) Policy

Begin Enteral Nutrition

Advance to Goal Rate

Emesis?  Yes → Hold TFs for 4 h and contact clinician  → Restart TFs at 25 mL/hr  → Tolerating?  Yes → Advance TFs to goal rate

No → Secondary Intolerance?  Yes → Check GRV  → < 500 mL?  No → Decrease TFs by 25 mL/hr for 4 hours  → Check GRV

< 500 mL?  Yes → Return TFs to patient and resume goal rate

No → Increase TFs to goal and monitor

Continue at goal rate and monitor

Volume Based Feeding (Pep uP) Implementation

- Started in August 2013 – 6 months of education
- Dietitian on rounds, and automatic dietitian consult
- Nursing and Resident education
- Continued follow-up
- Survey at 4 years

https://www.criticalcarenutrition.com/pepup/study-tools
Does any of this work?

- Feasibility Pilot- Retrospective review in TBI (2014-2016)
- Larger Retrospective review from our STICU database
  - Primary outcomes
    - Time to feeding initiation
    - Delivery of nutrients
  - Secondary outcomes
    - LOS
    - Mortality
    - Infections
    - Glycemic control
    - Mechanical ventilation
    - Transfusions
    - Refeeding syndrome
Feasibility Pilot Early and Adequate Feeding in the Critically Ill Brain Injured (TBI) Patient

- Retrospective review

- $n=50$ TBI patients ordered a volume-based feeding protocol with IM containing arginine/n3/nucleotides

- 78% of patients met protein and calorie needs by Day 5 – 100% by Day 7

Justice J et al. CNW 2017 abstract.
Larger Retrospective Review

- All STICU patients (n=492)
- Ordered a volume-based feeding protocol with IM containing arginine/n3/nucleotides

Results:

<table>
<thead>
<tr>
<th>Table 1. Patient Clinical, Demographic, and Nutrition Characteristics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Data</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Age (SD)</td>
</tr>
<tr>
<td>STICU LOSa</td>
</tr>
<tr>
<td>Injury severity scorea</td>
</tr>
<tr>
<td>Complication (pneumonia)</td>
</tr>
<tr>
<td>Blood glucose ≥200 mg/dL, d</td>
</tr>
<tr>
<td>Blood glucose &lt;70 mg/dL, d</td>
</tr>
<tr>
<td>Emesis, d</td>
</tr>
<tr>
<td>Met/exceeded energy goal, d</td>
</tr>
<tr>
<td>Met/exceeded protein goal, d</td>
</tr>
<tr>
<td>Energy, kcal/kg/d</td>
</tr>
<tr>
<td>Protein, g/kg/d</td>
</tr>
<tr>
<td>Protein deficit, g/d</td>
</tr>
</tbody>
</table>
Effect of Pep uP on Protein Goal

Effect plots by PEP uP group and meeting daily protein needs over the duration of STICU length of stay.
Odds of Meeting Protein Goal (80%)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre PEP uP</td>
<td>[reference]</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post PEP uP</td>
<td>11.84 (7.94 - 17.64)</td>
<td></td>
</tr>
</tbody>
</table>

Odds ratios for meeting or exceeding 80% protein goals using the PEP uP Protocol. All models adjusted for patient injury severity and presence of complications.
Effect of PEP uP on Caloric Goal
## Odds of Meeting Caloric Goal (80%)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre PEP uP</td>
<td>[reference]</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post PEP uP</td>
<td>4.98 (3.49 - 7.10)</td>
<td></td>
</tr>
</tbody>
</table>

Odds Ratio for meeting or exceeding 80% calorie goals using the PEP uP Protocol. All models adjusted for patient injury severity and presence of complications.
## VBF Results: GRV Checks and Adequacy

<table>
<thead>
<tr>
<th></th>
<th>Pre PEP uP</th>
<th>Post PEP uP</th>
<th>Post PEP uP</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GRV Checks</td>
<td>No GRV Checks</td>
<td></td>
</tr>
<tr>
<td><strong>Caloric Intake</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Met 80% &lt; 80%</td>
<td>695 (26.6%)</td>
<td>984 (55.9%)</td>
<td>895 (57%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>1914 (73.4%)</td>
<td>775 (44.1%)</td>
<td>676 (43.0%)</td>
<td></td>
</tr>
<tr>
<td><strong>Protein Intake</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Met 80% &lt; 80%</td>
<td>489 (18.7%)</td>
<td>990 (56.3%)</td>
<td>900 (57.3%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>2120 (81.3%)</td>
<td>769 (43.7%)</td>
<td>671 (42.7%)</td>
<td></td>
</tr>
</tbody>
</table>

Data on file
VBF Results: Safety

**Patients with an Event**

- Refeeding: Pre VBF 90, Post VBF 50
- Macroaspiration: Pre VBF 60, Post VBF 20
- Diarrhea: Pre VBF 80, Post VBF 50

**Total Episodes**

- Emesis: Pre VBF 40, Post VBF 60

Glycemic Control

Days of Hyperglycemia

- >200 mg/dL
  - Pre PEPuP: 14.1%
  - Post VBF: 8.7%
  - p < 0.0001

Days of Hypoglycemia

- <70 mg/dL
  - Pre PEPuP: 1.2%
  - Post PEPuP: 0.6%
  - p = 0.037

Glycemic Control

Occurrences of Hyperglycemia

- Pre PEPuP
- Post VBF

p < 0.0001

Occurrences of Hypoglycemia

- Pre PEPuP
- Post PEPuP

<70 mg/dL

p < 0.005

<50 mg/dL
But wait, there’s more...

• More pts in the post-PEP uP group that carried the diagnosis of DM

• So it should have been worse...but it was better!
Hyperglycemia in the ICU

Studies show hyperglycemia in the ICU can lead to poor patient outcomes:

• Higher risk of mortality
• Hyperglycemia is an independent risk factor for infections
• Blood glucose is an independent predictor of length of stay in the ICU and hospital

Secondary Outcomes

- No significant change in mechanical ventilation days
- No significant change in STICU LOS
- No significant change in hospital LOS
- Pneumonias reduced 42.1% pre-PEP uP and 12.5% post-PEP uP (p<0.0001)
An Added Bonus: TPN Usage

<table>
<thead>
<tr>
<th></th>
<th>Pre PEP uP</th>
<th>Post PEP uP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients</td>
<td>43 patients</td>
<td>26 patients</td>
</tr>
<tr>
<td>Days on TPN</td>
<td>345 days</td>
<td>260 days</td>
</tr>
</tbody>
</table>
Study Conclusions

• PEP uP (VBF) with no GRV checks in STICU:
  – Safe
  – More effective delivery of nutrients, including immunonutrients
  – Preferentially effective at delivering protein
  – Improved glycemic control
  – Decreased use of TPN
STICU Summary

- Feed early
- Use well-tolerated and evidence-based semi-elemental immunonutrition formula
- Form a change team and implement VBF to improve adequacy and assist blood glucose management
So why not everywhere?

- Data recently published
- Need the right people
  - Strong physician leadership
  - Strong dietitian willing to actively participate
  - Strong nursing leadership with a dedicated nursing staff
Thank you!

**QUESTIONS?**

Nutrition-related resources and tools are available from Nestlé Nutrition Institute:
nestlenutrition-institute.org

Visit MyCE at
MyCEeducation.com
Offering CE to dietitians and nurses