Current Nutrition Support Practices in Critical Care

Maria Novak, RD & Brandi Suarez, RD

Inova Fairfax Medical Campus
Falls Church, Virginia

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Nothing to disclose

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Objectives

- Identify various methods used to optimize enteral nutrition support
- Understand clinical situations where early enteral nutrition is safe & beneficial along with therapies that increase nutrition risk/nutrient requirement

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Inova Fairfax Medical Campus

~900 bed academic medical center
- Heart and Vascular Institute
- Women's and Children's Hospital
- Schar Cancer Institute
- Neurosciences Institute

Critical Care Units
- Medical/surgical
- Trauma
- Cardiovascular surgery
- Neuroscience
- Cardiac/coronary
- Neonatal
- Pediatric

Multidisciplinary Team
- Residents, interns, and medical students
- RNs, Advanced Practice Providers, Pharmacists, Respiratory Therapists, Speech/language Pathologist, PT/OT, Case Manager

16 Clinical Registered Dietitians

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High Nutrition Risk: Multiple Comorbidities and Critically ill

- Pulmonary (Chronic obstructive pulmonary disease, respiratory failure, intubated)
- Infectious Disease (Septic Shock, Pneumonia)
- Gastrointestinal tract (Gastrointestinal bleed)
- Renal (Acute Kidney Injury/Chronic Kidney Disease, Hemodialysis/Continuous Renal Replacement Therapy)
- Endocrine (pancreatitis)
- Multi-system organ involvement
- Substance abuse (Alcohol abuse, drugs)
- Surgery: General, vascular, abdomen, hepatic/pancreatic

Nutrition needs individualized based on patients PMHx and current clinical condition.

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High Nutrition Risk: Malnutrition

- Use of screening tools?... Malnutrition Screening Tool (MST) and clinical judgement

"Moderate" or "Severe" protein energy malnutrition related to … as evidenced by …
- Malnutrition Criteria (2 out of 6):
  - **Inadequate intake**
  - **Unplanned wt loss**
  - **Loss of muscle mass**
  - **Loss of subcutaneous fat**
  - Fluid accumulation
  - Decreased functional capacity

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High Nutrition Risk: Wounds

- Pressure, traumatic, surgical, diabetic, venous stasis, moisture-associated
- Any critically ill patient is at risk for developing a pressure injury (PI) during their ICU stay
  - Increased risk: elderly, malnourished, altered mobility, poor perfusion
- Dual role of nutrition - maintaining healthy skin & successful wound healing
  - Calories (individualized based on condition/status)
  - Protein: 1.25-1.5gm/kg body weight, up to 2gm/kg
  - Fluid: 30-35ml/kg or per condition/status
  - Adequate micronutrients
  - Additional amino acid supplementation
  - Oral nutrition supplements or nutrition support if oral intake remains inadequate

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2016 Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.)

B1. We recommend that nutrition support therapy in the form of early enteral nutrition (EN) be initiated within 24-48 hours in the critically ill patient who is unable to maintain volitional intake.

B2. We suggest the use of EN over parenteral nutrition (PN) in critically ill patients who require nutrition support therapy.

McClave SA, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN). *JPEN*. 2016

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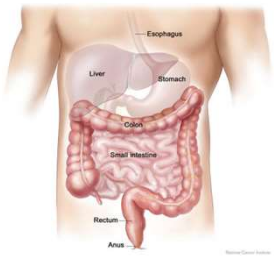
If the gut works,



USE IT!

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Indications for Enteral Nutrition (EN)

- Intubated or vent dependent, hemodynamically stable (stable blood pressure)
- Inadequate oral intake
- Dysphagia / esophageal obstruction
- Significant malnutrition / cachexia
- Head and neck surgery / cancer
- Pancreatitis
- Decreased mental status

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Indications for Small Bowel Feedings

- High aspiration risk
- Feeding intolerance (distension, vomiting)
- Reflux esophagitis
- Gastroparesis
- Pancreatitis / Whipple, other complex GI surgeries
- Gastric outlet obstruction

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Contraindications for EN

- Bowel obstruction, paralytic ileus
- Profuse vomiting and/or diarrhea
- GI ischemia
- Severe, active GI bleeding
- High-output fistulas (>500 ml/d)
- Severe short bowel syndrome (<100 cm remaining small bowel)

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Complications: Refeeding Syndrome

Acute intracellular shifts of K+, Mg+, and Phos as part of anabolic process
–results in low serum levels of these electrolytes

Who is at risk?
–Severely malnourished patients started on nutrition support

How is it prevented?
–Check electrolytes and replete ***before*** initiation of feeding
–Initiate feeding at low rate and advance gradually
–Monitor and replete as needed

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Ways to Optimize Nutrition Support in the ICU

Enteral Nutrition ICU protocols; evidence based practice

- Volume based tube feedings
- Reduced fasting prior to surgery/procedures
- Small bowel feeding
- Gastric Residual Volume
- Early EN Initiation and Advancement on Vasopressors
- Early EN Initiation and Advancement on Target Temperature Management (TTM)
- Early EN Initiation and Advancement during Prone Positioning

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Ways to Optimize Nutrition Support in the ICU

Volume Based Feeding Protocol

Tube feeding order will have "0" rate with a volume goal

Daily volume goal 1200 mls daily/24 hours, instead of hourly rate

Formula:

$$\frac{\text{Total daily volume (specified in TF order)} - \text{volume already given (on pump under history*)}}{\text{Hours left in the 24hrs cycle (hrs until midnight)}}$$

At midnight, the night nurse will either continue the same rate if no adjustments were made during the day or reset to the 24hr rate

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Ways to Optimize Nutrition Support in the ICU

- Reduce fasting time for planned procedures
  - Intubated patients on continuous gastric feeding via an OGT/NGT UNLESS undergoing an airway/GI procedure or proning for surgery
- Small bowel feeding
  - Post-pyloric enteral access system pilot study
- Gastric Residual Volume (GRV)
  - D2a. We suggest that GRVs not be used as part of routine care to monitor ICU patients receiving EN
  - D2b. We suggest that, for those ICUs where GRVs are still utilized, holding EN for GRVs <500ml in the absence of other signs of intolerance should be avoided

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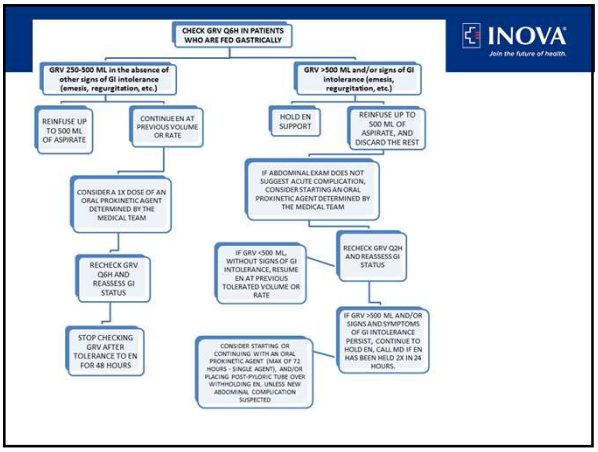

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Ways to Optimize Nutrition Support in the ICU

Early EN Initiation and Advancement on Vasopressors

1. Evidence has shown that it is safe to initiate enteral nutrition support in patients who are receiving Levophed equivalent dose of less than or equal to 12.5 mcg/min.
   - However enteral nutrition support should be based on clinical judgement of team
   - Patients receiving higher Levophed equivalent doses, as the risk of bowel ischemia increases, especially if:
     - Not adequately fluid resuscitated
     - MAP <65 mmHg (Mean Arterial Pressure)
     - Not started on a bowel regimen
     - Signs/symptoms of GI intolerance are present (abdominal distension, unexplained abdominal pain, emesis, regurgitation, lactate >4, etc.)
     - HOB is not maintained at ≥30 degrees

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Ways to Optimize Nutrition Support in the ICU

Early EN Initiation and Advancement on Target Temperature Management (TTM):

1. No need to withhold enteral nutrition support in patients undergoing TTM/Arctic Sun. Start enteral nutrition support within 24-48 hours in critically ill ICU patients if:
   - Adequately fluid resuscitated
   - MAP >65 mmHg
   - Started on a bowel regimen
   - No signs/symptoms of GI intolerance (abdominal distension, unexplained abdominal pain, emesis, regurgitation, lactate >4, etc.)
   - Head of bed maintained ≥30 degrees
2. During the cooling phase (32-34 degrees C):
   - Initial calorie goal: ~19 kcal/kg or 75-80% goal calories, accounting for calories from other sources.
3. During rewarming (36.4 degrees C): Increase TF rate by 10-20 ml q4h as tolerated
4. Monitor for signs/symptoms of GI intolerance.

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ARCTIC SUN® temperature management system used to reach and maintain a specific body temperature for therapeutic hypothermia or normothermia

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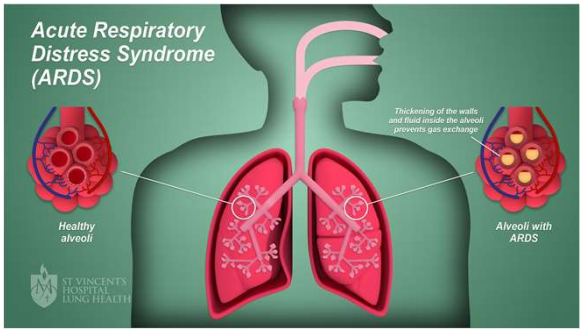

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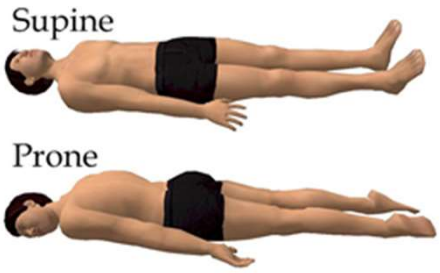
Acute Respiratory Distress Syndrome: Proning



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Ways to Optimize Nutrition Support in the ICU

Early EN Initiation and Advancement during prone positioning:

1. Start enteral nutrition support within 24-48 hours in critically ill ICU patients if:
   - Adequately fluid resuscitated
   - Head of bed maintained at or above 25 degrees (ideally 30-45 degrees if patients medical condition allows) while in prone position.
   - MAP >65 mmHg
   - Started on a bowel regimen
   - No signs/symptoms of GI intolerance (abdominal distension, unexplained abdominal pain, emesis, regurgitation, lactate >4, etc.)
1. Initiate with an enteral formula at trickle rate.
2. Advance rate of enteral formula to goal as tolerated per unit RD recommendations
3. Continue to monitor for signs/symptoms of GI intolerance.

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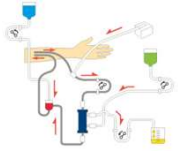
Complex Clinical Situations

Continuous Renal Replacement Therapy (CRRT)

- Continuous extracorporeal fluid and/or solute removal
  - Eases the metabolic consequences until renal recovery occurs
  - Able to more safely dialyze a hemodynamically unstable patient
- Multiple different modes that utilize the principles of ultra-filtration, convection, diffusion, or a combination



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Complex Clinical Situations - CRRT

- Nutrition Implications
  - Significant protein loss
    - Estimated loss of 10-15gm/day, provide a max of 2.5gm/kg
  - Potential energy gain or loss from the dialysate, replacement fluid, and/or type of anticoagulation being used
  - Micronutrient loss
    - Water-soluble vitamins (thiamine, folic acid, pyridoxine)
    - Trace elements (selenium, possibly chromium and zinc)
- Nutrition Support
  - Enteral is the prefered route of feeding
  - Electrolyte and volume-restricted formula not indicated, high protein formula is ideal
  - PN requires collaboration with Nephrology on volume and electrolytes

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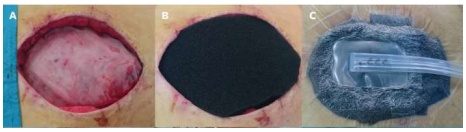
Complex Clinical Situations

Open Abdomen

- Management technique used in trauma/emergency surgery, vascular surgery, intra-abdominal sepsis, and abdominal compartment syndrome
- Temporary closure is required (negative pressure wound therapy is recommended, skin approximation techniques or grafting may be used)



Wounds 2018;30(10):310–316

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Complex Clinical Situations - Open Abdomen

ASPEN/SCCM (2016)

- M3a. Based on expert consensus, we suggest early EN (24-48 hours post injury) in patients treated with an open abdomen in the absence of a bowel injury
- M3b. Based on expert consensus, we suggest providing an **additional 15-30g of protein per liter of exudate** lost for patients with open abdomen. Energy needs should be determined as for other ICU patients.
- O4. We suggest enteral feeding for many patients in difficult postoperative situations such as prolonged ileus, intestinal anastamosis, OA, and need of vasopressors for hemodynamic support. Each case should be individualized based on perceived safety and clinical judgment. [Low to very low evidence]

ESPEN (2019)

- 3.17 Clinical question 17: Nutrition therapy in special conditions
  - Recommendation 40 - Early EN (within 48hrs of ICU admission) should be performed in patients with open abdomen

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Ways to Optimize Nutrition Support in the ICU; Case Study

60 y.o.well nourished male with PMH significant for HTN, and HLD presents to Emergency Department with frequent falls and flu-like symptoms. Was diagnosed with the Flu 2 days before admission. Diagnosed with acute hypoxic respiratory failure d/t PNA. He was subsequently intubated due to his worsening respiratory status and transferred to the ICU on 1/31. He quickly developed ARDS d/t flu and septic shock. Switched to prone position after difficulty oxygenating.

Day 2 of ICU stay: Pt switched back to supine position. Later in the day required reproning 2/2 desaturations and hypoxemia. Pt on vasopressors, paralytics, and sedation.

Night of Day 2: Overnight the team started trickle feeds of a low electrolyte/low volume formula

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Ways to Optimize Nutrition Support in the ICU; Case Study

Pertinent Labs: Glucose 166, BUN 37, Na 134, Cr 2.1, Phos 5.8

Pertinent Meds: Pepcid, Insulin regular, Meropenem, Pericolace, Vancomycin, Nimbex, Fentanyl, Levophed @5.067 mcg/min, Propofol @11.2 ml/hr (296 kcals), Vasopressin @.04 mcg/min

Anthropometrics: Height: 160 cm (5' 3"), Weight: 59.8 kg (131 lb 13.4 oz), Body mass index is 23.35 kg/m².

Nutrition Goals: 1500-1620 kcals (25-27 kcals / kg; while intubated); 65-80 gm pro (1.2-1.5 g/kg)

Recommendations: low electrolyte/low volume formula @ trickle rate

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Ways to Optimize Nutrition Support in the ICU; Case Study

Day 3: CRRT started. Tube feedings were held due to high gastric residuals (~500-600 mLs). Reglan started. Had BM x2. Tube feedings restarted @ trickle rate

Day 4-5: Pt remains intubated/sedated/paralyzed in proning position, still in ARDS, attempting to wean vasopressors. Residuals now <500 mLs during trickle feeds.

Labs: POCT glucose 148, Cr 2.0, Na 135, Phos WNL

Protein goals adjusted: 96-108 gm pro (1.6-1.8 g/kg increase for CRRT). Switched pt to high protein 1.5 kcal/mL formula with volume goal 840 mls with additional protein modular 4 packets daily.

*EN Goal: High protein 1.5 kcal/mL formula; 1080 mls when propofol discontinued.

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Ways to Optimize Nutrition Support in the ICU; Case Study

Day 6-7: Patient was proned a total of four times for his ARDS. EN continues at volume goal, tolerating well. Weaned off pressors.

Day 8-13: Breathing trials, remained stable off pressors, tolerating EN. Tracheostomy/Percutaneous Endoscopic Gastrostomy tube placed (PEG)

Day 13: CRRT discontinued. Nephrology monitoring daily for dialysis as needed.

Day 14: With CRRT off and electrolytes requiring repletion, switched to standard formula high calorie/low volume formula 840 mls daily.

Day 15-28: Remains in ICU for encephalophy continued respiratory distress. Still tolerating EN at volume goal.

After 28 days in ICU, pt transferred to the Intermediate Care Unit.

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Ways to Optimize Nutrition Support in the ICU; Case Study

- 22 year old healthy male involved in a motor vehicle collision
- Exploratory laparotomy: control of mesenteric hemorrhage, nonviable segment of small bowel resected with the bowel left in discontinuity and the abdomen left open
- Returned to the OR day 2 for small bowel anastamosis but still with bowel edema, abdomen again left open to facilitate another look
  - Patient returns to the ICU intubated and on high-dose vasopressors but able to be weaned overnight

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Ways to Optimize Nutrition Support in the ICU; Case Study

Ht: 177.8cm (5'10") Wt: 70kg (154lbs) BMI: 22.1kg/m^2

Labs: BG 112, BUN 16, creat 0.7, Na+138, K+4.2, Mg++2.0
Meds: pepcid, LR @100ml/hr, fentanyl, precedex, levophed @ 25mcg/min
Skin: complex scalp laceration repaired, abdominal Abthera wound vac
GI: OGT to low continuous suction

Estimating Needs
- Calories
  - 20-35 kcal/kg/day
    - 1750-1900 kcals (25-27 kcal/kg)
- Protein
  - 1.5-2 gm/kg general trauma range
    - 105-140gm protein
  - Additional protein depending on NPWT (negative pressure wound therapy) output

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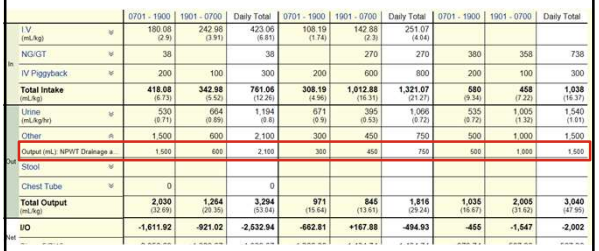

		0701 - 1900	1901 - 0700	Daily Total	0701 - 1900	1901 - 0700	Daily Total	0701 - 1900	1901 - 0700	Daily Total
In	I.V. (mL/kg)	180.08 (2.9)	242.98 (3.91)	423.06 (6.81)	108.19 (1.74)	142.88 (2.3)	251.07 (4.04)			
	NG/GT	38		38		270	270	380	358	738
	IV Piggyback	200	100	300	200	600	800	200	100	300
	Total Intake (mL/kg)	**418.08** (6.73)	**342.98** (5.52)	**761.06** (12.26)	**308.19** (4.96)	**1,012.88** (16.31)	**1,321.07** (21.27)	**580** (9.34)	**458** (7.22)	**1,038** (16.37)
Out	Urine (mL/kg/hr)	530 (0.71)	664 (0.89)	1,194 (0.8)	671 (0.9)	395 (0.53)	1,066 (0.72)	535 (0.72)	1,005 (1.32)	1,540 (1.01)
	Other	1,500	600	2,100	300	450	750	500	1,000	1,500
	Output (mL): NPWT Drainage a...	1,500	600	2,100	300	450	750	500	1,000	1,500
	Stool									
	Chest Tube	0		0						
	Total Output (mL/kg)	**2,030** (32.69)	**1,264** (20.35)	**3,294** (53.04)	**971** (15.64)	**845** (13.61)	**1,816** (29.24)	**1,035** (16.67)	**2,005** (31.62)	**3,040** (47.95)
Net	**I/O**	**-1,611.92**	**-921.02**	**-2,532.94**	**-662.81**	**+167.88**	**-494.93**	**-455**	**-1,547**	**-2,002**

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Ways to Optimize Nutrition Support in the ICU; Case Study

Goal EN: 1200ml daily volume of a 1.5kcal/ml high protein formula with additional protein modular to provide 1960 kcals and 156gm protein

Day 3: trophic tube feeds started at 20ml/hr
- Gastric residuals are 200-400mls

Day 4: a bedside washout is done with wound vac replacement
- Tube feeds restarted at 20ml/hr afterwards, tolerance improves

Day 5: tube feeds increased to goal and patient tolerates

Day 7: delayed abdominal closure, superficial wound vac is placed over the midline wound, output is <200ml/day. Still tolerating EN goal daily volume, additional protein modulars adjusted to provide 134gm (105-140gm protein)

Day 12: unable to wean off mechanical ventilation, surgery performs a tracheostomy/PEG-tube placement

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Our Implementation Experience!

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