Vanderbilt University Medical Center
Surgical ICU Nutrition Management Guidelines

Clinical judgment may supersede guidelines as patient circumstances warrant

ASSESSMENT AND EVALUATION

- All patients admitted to the Surgical Intensive Care Unit require a nutrition risk assessment within 24 hours and a nutrition plan within 48 hours
- Consult Nutrition Service as needed for specific recommendations (i.e. tube feeding formulations, oral supplements, poor oral intake, education)

ADMINISTRATION

- Enteral nutrition (EN) is preferred over parenteral nutrition (PN)
- Reduce risk of aspiration by reducing sedation, elevating HOB 30 – 45 degrees, performing mouth care per VAP Guidelines, minimizing transport out of ICU, and ensuring EN is given by continuous administration

Oral Nutrition

- Oral intake preferred method of nutrition if appropriate for patient
- Initiate regular diet with oral diet advancement (add oral supplement to optimize PO intake)

Enteral Nutrition

- Initiation
    - Initiate EN within 24 – 48 hours following onset of critical illness and admission to ICU, after resuscitation efforts completed and/or hemodynamic stability achieved
    - Initiate EN and advance to goal as quickly as tolerated within 48 – 72 hours
- Weaning (transitioning to PO diet)
    - Cycle EN x 12hr, 19:00 – 07:00 (for 50% of needs during first few days of transition)
    - Consider discontinuation of EN once patient consistently consumes and tolerates on average 60% or more of meals
- Feeding access:
    - Lower GI tract preferable if EN access needed, especially with high aspiration risk, but nutrition should not be delayed if only gastric access obtained

	Gastric	Post-pyloric
Short-term	• orogastric tube (OGT) • nasogastric tube (NGT) • Dobhoff tube (DHT)	• DHT (via Cortrak and placement confirmed by abdominal radiographic imaging (KUB))
Long-term	• percutaneous endoscopic gastrostomy (PEG)	• PEG-Jejunostomy (for unsuccessful placement DHT for post-pyloric access) • surgical jejunostomy

Parenteral Nutrition

- Nutrition risk and malnutrition
    - Patients at high nutrition risk are most likely to benefit from aggressive nutrition therapy.
        - Nutrition risk increases with age >50 years, APACHE II >15, SOFA score >6, number of medical co-morbidities, and days from hospital to ICU admission.
        - Degree of nutrition risk determines how quickly to initiate/advance EN and when to initiate PN.
    - **If low nutrition risk** and unable to meet ≥ 50% energy and protein requirements via PO/EN after 7 days, then initiate PN

        - Most patients in the SICU are at high nutrition risk, not at low nutrition risk
    - **If high nutrition risk** and unable or unlikely to achieve desired PO/EN intake after 3 – 5 days, initiate PN
    - **If malnutrition is present** upon admission to the SICU and PO/EN is not possible or sufficient, initiate PN as soon as possible
- PN is re-ordered daily by the Adult Nutrition Support Team (NST) with consideration of energy and protein intake from PO/EN. Contact Adult NST (pager 615-835-0419) for PN discontinuation when the following parameters are met:
    - PO/EN is currently at or expected to be advanced to meet ≥ 60% of goal by the end of the day
    - Low risk of intolerance to or interruption of PO/EN advancement
- If patient has a high risk of intolerance to PO/EN advancement or further interruption to PO/EN is expected over the next day, contact the Adult NST to consider continuation of PN with reduced energy provision
    - Regardless of nutrition risk, if a patient is not meeting >60% energy and protein requirements by PO/EN (alone or in combination) by 7 days, consider initiation of supplemental PN

DOSING

- Dosing weight
    - BMI ≥25: use ideal body weight (IBW) or upper IBW (110% IBW)
        - Hamwi Method for calculation of IBW:
            - Men: 106 lb (48kg) for 1st 5 feet, then add 6 lb (2.7kg) for every inch over 5 feet, +/- 10%
            - Women: 100 lb (45kg) for 1st 5 feet, then add 5 lb (2.3kg) per inch over 5 feet, +/- 10%
    - BMI <25: Use actual (dry) body weight
- Energy goals:
    - Non-obese: 25 – 30 kcal/kg dosing weight/day
    - Obesity
        - BMI 30 – 50: 11 – 14 kcal/kg actual body weight
        - BMI over 50: 22 – 25 kcal/kg IBW/day
- Protein goals:
    - General: 1.2 – 2 g/kg dosing weight/day
    - Obesity
        - BMI 30 – 39: 2g/kg IBW/day
        - BMI 40 and above: 2.5g/kg IBW/day
    - Renal Failure:
        - HD 1.2 to 1.8 g/kg dosing weight
        - CRRT: 2 - 2.5g/kg dosing weight
        - Hepatic Failure: 1.2 – 2 /kg dry or actual body weight/day
        - Open Abdomen: 2 – 2.5 g/kg dosing weight to provide an additional 15 – 30g/liter of exudate lost
- Fluid Needs
    - General: 30 – 40 ml/kg for maintenance fluid requirements
    - Cover additional losses (i.e. fever, diarrhea, other GI output) with replacement IV fluids if needed
    - Consider fluid restriction for patients with CHF, renal failure, hepatic failure w/ ascites, ARDS, pulmonary edema, or peripheral edema/anasarca

MONITORING

- Serum protein markers (albumin, prealbumin, CRP) not recommended for evaluation of nutritional status or goals
- GI Intolerance
    - Gastric residual volume (GRV) not utilized as routine evaluation of tolerance. Daily physical examination, patient symptoms (nausea, vomiting/high gastric output, diarrhea), clinical risk factors, and abdominal radiographic films should be utilized to determine tolerance.
    - Prokinetic agents may be introduced if GI intolerance suspected or for patients with high risk of

aspiration. Consider risk of QTc prolongation.
    - Erythromycin 200mg IV or PO/per tube q6h x 3 days
    - Metoclopramide 10mg IV q6h x 3 days
    - Used rarely: Naloxone 8mg PO/per tube q8h x 3 days, then 8mg q6h prn
- Diarrhea
    - For persistent diarrhea and after C. difficile infection has been ruled out, consider the following:
        - Fiber
            - Nutrisource Fiber 1 packet BID; may increase to a maximum of 2 packets TID (i.e., maximum of 6 packets/day).
            - Metamucil may also be considered, but volume of water required with each dose may not be well-tolerated and propensity for tube clogging may limit its utility.
        - Antidiarrheals
            - First line: loperamide (Imodium®) 1 – 4 mg up to 4 times/day; max of 16 mg/day
            - Second line (once loperamide dose is maximized): diphenoxylate/atropine (Lomotil®) 2.5 - 5 mg up to 4 times/day

SPECIAL CONSIDERATIONS

- Refeeding syndrome
    - For patients at risk for refeeding syndrome, check BMP, magnesium, and phosphorus levels at baseline and replete electrolytes prior to initiation of EN, PN, or dextrose-containing IV fluids.
    - Provide thiamine, folic acid and multivitamin prior to initiation of EN.
        - Not necessary for patients on PN. Patients at refeeding risk and receiving PN will have additional supplementation of these micronutrients in PN formula.
        - Thiamine 100mg PO daily for 3 – 7 days
        - Folic acid 1mg PO daily for 3 – 7 days
        - Multivitamin daily
            - Per tube: Adult Liquid Multivitamin/minerals 15 mL per tube daily
                - Note: must order with folic acid – this product does not contain folic acid
            - PO: Vicon® Multivitamin/minerals/folic acid capsule
    - Initiate trophic feedings (no more than 25% of goal) and advance to goal over 3 – 4 days.
    - Continue to check BMP, magnesium, and phosphorus at least once daily as EN/PN advances to goal.
- Open Abdomen
    - Early EN recommended 24 – 48 hours after injury, without evidence of bowel injury
    - Consider PN if bowel is in discontinuity and patient is unlikely to receive adequate EN within the next 3 – 5 days.
        - Consider PN as soon as possible if patient has moderate or severe malnutrition and EN is unable to be provided.
- Hyperglycemia
    - VUMC EN formulary does not have a “diabetic” EN formula.
    - Peptamen Intense VHP will provide lowest amount of carbohydrate per EN goal.

- Wound Healing
    - For large wounds and risk factors for micronutrient deficiencies, consider supplementing with the following:
        - Multivitamin daily
            - Per tube: Adult Liquid Multivitamin/minerals 15 mL per tube daily
                - Note: This product does not contain folic acid or vitamin K. Supplement these separately if needed.
            - PO: Vicon® Multivitamin/minerals/folic acid capsule
        - Ascorbic acid 500 mg PO/per tube BID

        - Vitamin A 10,000 international units PO/per tube daily
        - Zinc 50 mg (elemental) PO/per tube daily
        - Baseline status of vitamin A and zinc should be assessed using the guidelines below. If no deficiencies are present and the patient is receiving adequate nutrition, supplementation should be discontinued.
- CRRT
    - Regardless of intake from EN, schedule the following empirically upon CRRT initiation and continue for the duration of CRRT:
        - Adult Liquid Multivitamin/minerals 15 mL per tube daily
        - Thiamine 100 mg per tube daily
        - Folic acid 1 mg per tube daily
        - Ascorbic acid 500 mg per tube BID
    - After 7 days, begin copper 2 mg daily and check the following labs:
        - C-reactive protein (CRP; to guide interpretation of micronutrient levels)
        - B1 (thiamine), **whole blood**
        - B6 (pyridoxine)
        - B9 (folate)
        - Copper
    - If deficiencies are present, contact SICU or Nutrition Support Pharmacists for dosing recommendations. Refer to the following table for interpretation of micronutrient levels in relationship to CRP. The majority of micronutrients cannot be interpreted correctly in critically ill patients without a CRP.

Micronutrient	**CRP < 15 mg/L**	**CRP 100 – 200 mg/L**	**Interpretation with elevated CRP**
Copper	10 – 15 % **increase**	30% **increase**	Actual level is **LOWER** than lab result.
Zinc	10% decrease	40 – 60% decrease	Actual level is higher than lab result. Patients on RRT may have elevated levels due to contamination of dialysate fluids during the manufacturing process.
Selenium	10% decrease	40 – 60% decrease	Actual level is higher than lab result.
Vitamins B 1, 2, 9, 12	No change	No change	Interpret results based on normal ranges.
Vitamin B 6	? decrease	40 – 50% decrease	Actual level is higher than lab result.
Vitamin C	-----	> 75% decrease	Unless vitamin C deficiency is suspected, checking levels during critical illness should generally be avoided due to limited utility of lab results.

ASSOCIATED MDSCC PROTOCOLS

- Glycemic Protocol
- Electrolyte repletion protocol
- Gastrointestional Stress Ulcer Prophylaxis
- VAP Protocol

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2. McClave SA, Taylor, BE, Martindale RG, 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 of Parenteral and Enteral Nutrition (ASPEN). JPEN J Parenter Enteral Nutr 2016; 40 (2): 159-211.
3. Compher C, Bingham AL, McCall M, et al. Guidelines for the provision of nutrition support therapy in the adult critically ill patient: The American Society for Parenteral and Enteral Nutrition. JPEN J Parenter Enteral Nutr 2022:1-30.
4. Worthington P, Bechtold M, Bingham A, et al. When is parenteral nutrition appropriate? JPEN J Parenter Enteral Nutr 2017;41(3):324-77.
5. Galloway P, McMillan DC, Sattar N. Effect of the inflammatory response on trace element and vitamin status. Ann Clin Biochem 2000;37:289-97.
6. Berger MM, Shenkin A, Schweinlin A, et al. ESPEN micronutrient guideline. Clin Nutr 2022;41:1357-1424.

Appendix 1. SICU enteral nutrition formulations

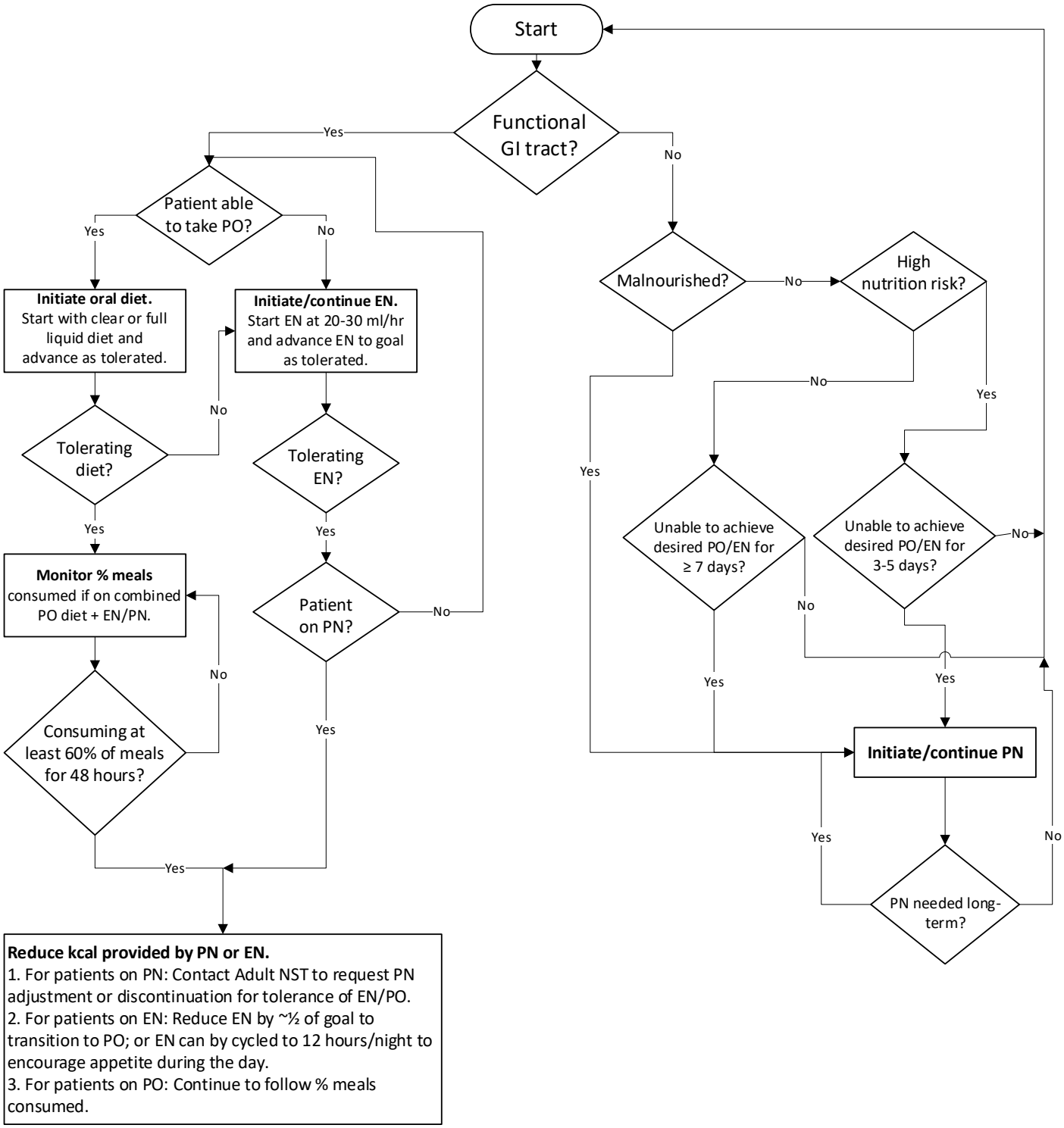
Critically ill	Obese and critically ill	Non-critically ill
Impact Peptide 1.5 (immune-modulating)	Peptamen Intense VHP (very high protein)	Isosource HN Nutren 1.5 Nutren 2.0 Fibersource HN

Consult Clinical Nutrition for disease specific formulations in SICU

Respiratory failure	CKD/HD	AKI/CKD requiring CRRT	Acute pancreatitis	MODS/Chyle leak	Modulars
Nutren 2.0	Novasource Renal (electrolyte restricted)	Impact Peptide	Peptamen 1.5	Vivonex RTF 1.0	Nutrisource Fiber Prostat Max (Protein)

Compleat Formulas		
Compleat 1.06 (contains fiber – no corn or soy)	Compleat Standard 1.4 (plant-based, vegan)	Compleat Peptide 1.5 (plant-based, vegan, peptide-based)

Appendix 2. Enteral/Parenteral Nutrition Pathway



Appendix 3. Pre-operative enteral nutrition protocol for patients with protected airway (trach/oral ETT)

NON-ABDOMINAL SURGERY

- Turn EN off just prior to OR departure or bedside procedure
- Gastric tube will be flushed and aspirated

ABDOMINAL SURGERY OR OPERATIVE INTERVENTION REQUIRING PRONE POSITIONING

- Turn EN off 6 hours before planned anesthesia
- Gastric tube will be flushed and aspiration prior to OR departure

UPPER GI ENDOSCOPY

- Turn EN off 1 hour prior to elective endoscopy
- Place NGT to suction

OTHER CONSIDERATIONS

- Stop insulin infusion prior to OR transport
- Alert anesthesiology to perform accucheck perioperatively in OR if SQ insulin given within 2 hours
- Restart EN post-surgery unless orders to hold post-surgery
- Patient with confirmed post-pyloric feeding tube, consider perioperative continuous feeding by anesthesiology and surgeon
- PN should not be stopped or disconnected for surgery

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