NUTRITION SUPPORT OF THE TRAUMATICALLY INJURED PATIENT

Original Release/Approval	1 Mar 2010	Note: This CPG requires an annual review.	
Reviewed:	Jan/Feb 2010	Approved:	1 Mar 2010
Supersedes:	This is a new CPG and must be reviewed in its entirety		
☐ Minor Changes *(or)*	☐ Changes are substantial and require a thorough reading of this CPG *(or)*		
☐ Significant Changes			

1. Goal/Objective.

a. To define an approach to optimal nutritional support in the critically ill or injured patient.

b. To establish meaningful goals for implementing enteral nutrition.

c. To provide an understanding of the various formulations for enteral nutrition and their use.

d. To establish the indications for total parenteral nutrition (TPN).

2. Definitions.

- Enteral nutrition (EN): the use of the stomach, duodenum, or jejunum to provide the nutrition targets to optimize healing and normal physiologic function.

- Total parenteral nutrition (TPN): formulated nutritional substrate provided intravenously to optimize healing and normal physiologic function.

3. Guidelines.

a. Consult Medical Nutrition Therapy on all ICU patients for nutritional assessment and cooperative guidance on nutritional support.

b. Enteral nutrition should be the first choice over total parenteral nutrition for the patients unable to consume food on their own. Enteral nutrition maintains gut mucosal integrity and immuno-competence.

c. The following conditions are **ABSOLUTE CONTRAINDICATIONS FOR ENTERAL NUTRITION:**

1) High risk for non-occlusive bowel necrosis

a) Active shock or ongoing resuscitation

b) Persistent mean arterial pressure (MAP) < 60mmHg

2) Generalized peritonitis

3) Intestinal obstruction

4) Surgical discontinuity of bowel

5) Paralytic ileus

6) Intractable vomiting/diarrhea refractory to medical management

7) Mesenteric Ischemia
8) Major gastrointestinal bleed
9) Increasing requirement for vasoactive support to maintain MAP > 60mmHg
10) High output uncontrolled fistula

d. The following conditions are **RELATIVE CONTRAINDICATIONS FOR ENTERAL NUTRITION:**

1) Body temperature < 96 F
2) Requirement for continuous neuromuscular blockage
3) Concern for abdominal compartment syndrome as evidenced by bladder pressure trending higher and/or > 25mmHg

e. Indications for **ENTERAL NUTRITION** include:

1) Any patient on the trauma service who is anticipated to remain unable to take full oral intake on their own.
2) Any patient who has oral intake with supplementation that is inadequate to meet current nutritional needs (i.e. < 50% of estimated required calories for >3 days)

f. Indications for **PARENTERAL** (**TPN**) include:

1) Unable to meet > 50% caloric needs enterally by day 5 from time of injury and has a contraindication to enteral nutrition.
2) Any of the contraindications for enteral nutrition listed in 3.c above that persist and patient without nutritional support for 3 days
3) Massive small bowel resection refractory to enteral feeds
4) High output fistula after failure of elemental diet

g. Enteral access will be established ideally within 24 hours of admission to the hospital

1) If the patient will be taken to the operating room (OR) within 24-48 hours of arrival for a laparotomy procedure, a surgically placed naso-jejunal feeding tube (NJFT) should be placed while in the OR
2) If the patient is not a candidate for operative placement, use whatever means available to place a feeding tube. (i.e. placement of an endoscopic NJFT/fluouroscopically guided, magnet guided, etc.)
3) If unable to place NJFT, consider use of orogastric (OG) or nasogastric (NG) tube during stay with intent to discontinue enteral feeds 6 hours prior to aeromedical evacuation (AE) flight and selected procedures (e.g. surgery). Due to the intermittent nature of the feedings with the need for frequent holdings for patient movement and/or procedures, it is emphasized that this is NOT the preferred method of feeding these patients.

4. Formula Selection

a. Immune modulating diet (e.g. IMPACT with glutamine or equivalent) with soluble fiber – high protein, isotonic, polymeric feed supplemented with additional glutamine. Use for:

1) Major trauma patients for the first 7 days of nutrition support

2) Moderately malnourished patients (pre-albumin < 15gm/dl) undergoing major elective procedures of the esophagus, stomach, pancreas, hepatobiliary tree or abdominal-perineal resection

3) Severely malnourished patients (pre-albumin < 10gm/dl) undergoing large bowel resection

4) Prolonged starvation > 6 days

5) High output distal colonic fistula

b. Immune modulating elemental formula (Optimental) with small amount of soluble fiber – Moderate protein, isotonic feed supplemented with Omega-3 fatty acids, probiotics and arginine. Elemental formulas are easily absorbed. Use for:

1) Proven intolerance to the first formula used

2) Persistent, severe diarrhea > 48hrs

3) Burn patients

4) Pancreatic or duodenal injury

5) Moderate distention > 24hrs

6) Short bowel syndrome

7) At discretion of attending physician

c. Polymeric high protein, fiber free formula (Osmolite1.2) – Isotonic enteral feed with long-chain proteins, carbohydrates and a normal fat content, use for:

1) Patients with a moderate protein need, normal digestive and absorptive capacity of the GI tract

d. Polymeric with mixed fiber formula (Jevity1.0) – Added fiber content to promote more formed stool. Use for:

1) Stable, long term patients and those requiring a bowel regimen (i.e. paraplegics)

e. Other formulas include:

1) Isosource 1.5 - high protein, high calorie, soluble fiber containing formula with 1.5 kcal/ml to limit volume.

2) Nepro – therapeutic nutrition with mixed fiber for patients on dialysis needing fluid and electrolyte restrictions (may require protein supplementation.)

f. Additional fiber source:

1) If additional fiber is needed for stool management, use the soluble variety (e.g. Benefiber® or equivalent).

5. Nutritional Energy/Protein Requirements

Nutritional energy/protein requirements are based on the patient's current nutritional status and severity/type of trauma suffered. Below are some basic guidelines:

a. Kcal:
   1) 25-35 kcal/kg dry weight for high stress trauma/burn patients
   2) 20-25 kcal/kg dry weight for ventilated patients
   3) 15-20cal/kg adjusted weight for obese patients
      a) Obesity is defined as a Body Mass Index (BMI) > 30
      b) BMI (kg/m2) = (lbs. x 703)/(inches2)

b. Protein:
   1) 1.0-1.5 grams protein/kg
   2) 1.5-2.0 grams protein/kg in major trauma/ burn / head injured/obese patients

c. Fat: 30% of calories (may be less in burn patients 15-20%)

d. Free Water: 1ml/kcal

e. Please be careful in your evaluation of this patient population. Many are young, healthy, and very muscular. If they are muscular with a BMI>30, you should use their estimated actual weight pre-injury. Those with a BMI>30 due to obesity should use the adjusted weight as stated above. Pick any formula you like (e.g. Hamwi Female – 100 lbs for 5 feet plus 5 lbs for every inch over 5 feet; Male – 106 lbs for 5 feet plus 6 lbs for every inch over 5 feet) as they are all 70-80% accurate compared to a metabolic cart study. These are not available until the patient reaches a CONUS facility and should be used as soon as possible to get the gold standard for caloric and macronutrient requirements.

6. Enteral Nutrition Initiation and Advancement

a. Start enteral tube feed with full strength formula at 20ml/hour

b. Increase rate by 20ml/hour every 6-8 hours to goal rate

c. For BURN and HEAD injured patients with no abdominal trauma or other contraindications, advance 20ml every 4 hours to goal rate

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Note: Caveat to this is when patient is being transferred from one level of care to the next in a ***rapid*** fashion (i.e. FOB to Level 3 to LRMC). Given the difficulty in monitoring feeding tolerance on the AE/CCATT mission, it may be best to hold initiation of feeds until patient will be at one place for at least 24 hours. The risk of aspiration in an awake patient or intolerance in an intubated patient is real and necessitates appropriate repeated examinations until well established prior to any flights.

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7. Glutamine (when available)

Glutamine administration, separate from enteral formula, should be started upon patient's arrival in the ICU.

a. Glutasolve® is a powder supplement that provides 90 kcals and 15 grams of L-glutamine per packet

b. Administer Glutasolve on all patients requiring vasoactive pressor support, mechanical ventilation, trauma resuscitation, TPN, CVVHD, or HD

Note: Do not administer for liver failure patients, those with acute renal failure with sCr> 3.0mg/dl who are not on dialysis, or patients with total bilirubin > 10mg/dl

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c. Dose glutamine:

1) 0.5grams/kg dry weight daily for 7 days after admission to the ICU

a) For < 81 kg patients start with 1 packet twice a day

b) For > 80 kg patients start with 1 packet three times a day

2) Continue supplementation when enteral nutrition is initiated unless using IMPACT© with glutamine. If this product is used, the supplemental glutamine should be discontinued once goal rate is achieved.

d. Glutasolve must be dissolved in 60 – 120 ml of WARM water and infused immediately via the OG tube.

Note: If the dissolved Glutasolve® sits for more than 15 minutes prior to administration it must be wasted and a new packet used. It may be administered via the NJFT if no gastric tube *and* the NJFT is larger than 8F. Be sure to flush tube with an additional 20ml water afterwards to maintain patency.

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8. Enteral Supplementation For Those Patients Tolerating a Diet

Many traumatically injured patients can tolerate a regular diet. For various reasons, however, patients may be subjected to frequent holding of oral intake for procedures, recovery periods after procedures, decreased appetite due to medications, etc.

a. Supplementation drinks when patient is eating can help bridge some of the caloric deficits and provide nutritional therapeutic benefits missed during the time-limited periods of inadequate intake.

b. Recommendations are for high-protein drinks (i.e. Ensure Plus®, Impact© Advanced Recovery™, or equivalent) at 0.5-1.0 L per day (3-4 drinks) in addition to meals.

c. If the patient is on a less than a regular diet (e.g. clear or full liquid) consider the use of Glutasolve (15g glutamine/packet) 2-3 times a day, as this product is easily dissolved in other drinks and best if consumed immediately after mixing. Of note, glutamine is

already included in the Impact Advanced Recovery™ supplement, if that particular product is used.

9. Enteral Nutrition Intolerance

Management: (see Appendix A)

a. Vomiting
   1) If no OG tube in position, place one and initiate low intermittent wall suction
   2) Check existing OG tube function and placement location
   3) If OGT is in proper position and functional, decrease tube feed rate by 50% and notify physician for further evaluation and work up
   4) Ensure patient is having **normal** bowel elimination

b. Abdominal Distention
   1) Mild: Obtain history if possible and physical exam; maintain current tube feed rate. Continue to monitor.
   2) Moderate: Perform history and physical exam
      a) Maintain current tube feed rate and do not advance
      b) Obtain portable abdominal x-ray to assess for small bowel obstruction or ileus.
      c) If distention persists >24hrs with no contraindication for continued tube feeds, switch to elemental formula
      d) If feeding while the patient is on vasopressors, any increase in distention should prompt holding tube feeds.
   3) Severe: Perform history and physical exam
      a) Stop tube feed infusion
      b) Monitor fluid status
      c) Consider workup – CBC, lactate, ABG, Chem7, CT scan abdomen
      d) Check bladder pressure

c. Diarrhea
   1) Mild: 1-2 times/24hrs or 200-400ml/24hrs
      a) No change – continue tube feeds and advance per protocol
   2) Moderate: 3-4 times/24 hrs or 400-600ml/24hrs
      a) Maintain tube feeds at current rate, do not advance rate
      b) Review medication record for possible causes of new onset diarrhea
      c) Consider sending stool for Clostridium difficile (C. diff) on three sequential stools
   3) Severe: >4 times/24hrs or >600ml/24hrs
      a) Decrease tube feed rate by 50%

b) Review medication record for possible causes of new onset diarrhea

c) Send stool specimen for C. diff on three sequential stools

d) Obtain abdominal x-ray to evaluate feeding tube location

e) Consider switching to an elemental, non-fiber formula. This is highly recommended if diarrhea persists for >48hrs after treatment. If C. diff positive, treat with Flagyl. Only start anti-diarrheals after 48hrs of antibiotic treatment if diarrhea persists.

f) If C. diff negative, give 2 mg loperamide after each loose stool, alternative is 15mg codeine

g) Monitor fluid and electrolyte status

May consider addition of probiotics if patient without pancreatitis in all three categories.

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d. High OG output (>1200ml/24 hrs) with OGT to continuous suction and feeding via NJFT

1) Stop tube feeds

2) Obtain abdominal x-ray to evaluate location of OGT and NJFT

a) Verify OGT is in the stomach. If OGT is past pylorus, pull it back into stomach and resume tube feeds at previous rate

b) Verify NJFT is in correct position. If NJFT is in the stomach take appropriate action to move the tube to the appropriate position. If NJFT is in the correct position decrease tube feeds by 50% and assess patient's overall condition

3) Check OG aspirate for glucose testing in lab

a) If glucose >110, hold tube feeds for 12 hours and re-evaluate

b) If glucose negative, resume tube feeds at 50% previous rate

e. Increased gastric residual volumes (GRV) with OG feeding

1) If feeding through OGT, check gastric residuals every 4 hours.

2) Re-infuse the entire gastric aspirate or administer an equivalent volume of ½ NS

3) If GRV >300 ml on two consecutive checks, call physician

4) Start Erythromycin 250 mg IV or oral every 6 hours or Reglan 10mg IV every 6 hours and continue every 4 hour residual checks

5) Hold enteral feeds only when ordered by physician

10. Medication Considerations

a. Inotropic agents (Dobutamine, Milrinone) – No change to feeding plan recommended. Advance per feeding protocol

b. Paralytics, vasoactive agents (i.e. vasopressin>0.04units/min, dopamine >10mcg/kg/min, norepinepherine > 5 mcg/min, phenylepherine > 50mcg/min, any epinephrine)

1) Continue Glutasolve

2) Elemental formula at 20 ml/hr – do not advance
3) Consider TPN starting day #5 from time of injury
4) Hold tube feeding if adding vasopressor, increasing dosages or MAPS < 60

11. General Considerations

a. General considerations for patients receiving enteral nutrition into the jejunum:
   1) Maintain head of bed > 30 degrees at all times or in reverse Trendelenburg position if spine not cleared
   2) Obtain portable abdominal X-ray within12 hours CCATT or AE movement to confirm feeding tube location is within jejunum
   3) Enteral nutrition administered into the jejunum (past the ligament of Treitz) does NOT need to be stopped prior to going to the operating room, diagnostic tests, CCATT/AE transport, lying flat for procedures, etc.
   4) Keep OGT on intermittent low wall suction while initiating and advancing tube feeds via feeding tube
   5) TPN is only used when enteral nutrition is not possible and patient meets the requirements listed under 3.f above
   6) See attached sheet for ordering TPN
   7) Ensure patient has a clean, dedicated central intravenous line for administration of TPN.

12. General Considerations

General considerations for patients receiving gastric feeds:

a. Gastric feeds may be necessary to initiate early enteral nutrition but are highly discouraged in this trauma patient population during the period of rapid transport to CONUS.
b. If the clinical scenario warrants consideration of gastric feeding, it must be discussed with the attending trauma surgeon and coordinated among the entire multidisciplinary team.

13. Laboratory Evaluation

a. Obtain a pre-albumin and CRP every Monday for those with ICU stays greater than 7 days.
b. Obtain liver function tests (LFTs) and lipid panels at baseline and every Monday for those on TPN.

14. Bowel Regimen

Those patients at high risk for acute constipation should be started on a bowel regimen. If a patient is receiving tube feeds and has less than 1 bowel movement (BM) every 2 days, they should be started on the bowel care protocol. A bowel care protocol also may be started empirically with initiation of enteral nutrition in patients know to be at risk for constipation.

a. Inclusion criteria includes patients at high risk for acute constipation:
   1) opioids
   2) immobility
   3) altered diet and fluid intake
   4) stress
   5) history of constipation

b. Relative exclusion criteria includes:
   1) rectal surgery
   2) abdominal pain
   3) allergy to medications
   4) neutropenia (ANC<1000mm3)
   5) thrombocytopenia (platelets <30,000)

c. Absolute exclusion criteria is suspected or confirmed bowel obstruction

d. If patient has had one BM every 2 days, pt is at Level One or under observation only.

e. Level One if no BM for 48 hours

   Patient assessment and rectal exam.
   1) Impacted: manually dis-impact; give soap suds enema once OR Bisacodyl 10 mg suppository once daily.
   2) Not impacted: Docusate 100mg PO or NJFT q 8 hours and Senna 1 tab PO or 5ml via NJFT every am
   3) If no BM or very small amounts in 24 hours following initiation of Level One, proceed to Level Two.

f. Level Two
   1) Add Bisacodyl 10 mg supp once daily, hold if stooling and continue with Level One regimen
   2) If no BM or very small amounts within 24 hours, proceed to Level Three.
   3) If patient develops loose stools or diarrhea, return to Level One

g. Level Three
   1) Add Milk of Magnesia 30 ml PO every 6 hours or Miralax 17 grams PO/NJFT twice daily for renal disorders until BM, then stop. Return to Level Two.
   2) If no BM in 24 hours or very small amounts, proceed to Level Four.
   3) If patient develops loose stools or diarrhea, return to Level One

h. Level Four
   1) Call and notify MD. Obtain a KUB. Clarify continued therapy for bowel care.

15. Bowel Management System (Zassi Or Equivalent)

For patients requiring the use of the BMS for wound care and/or stool management, please refer to those separate guidelines for specific product recommendations.

16. Vitamin and Trace Mineral Supplementation

Continue for 7 days and then re-assess patient's clinical and nutritional condition. Evaluate closely dosing in renal and liver failure patients.

a. Vitamin C 1000mg IV every 8 hours
b. Zinc sulfate 220mg tab PO once a day
c. Vitamin E 1000-1200IU PO/OGT/NJFT every 8 hours
d. Selenium 200mcg IV or PO/OGT every 24 hours
e. Multivitamin tab, elixir, or IV once a day
    1) Prenatal vitamins are often an excellent choice for supplementation if iron is also needed
    2) For those unable to swallow a large pill or for whom the iron causes GI upset, children's chewable vitamins (e.g. Flintstone's™ Complete or equivalent) are well tolerated.

17. NJFT Maintenance

a. Due to the size (8-12F) of the NJFTs, meticulous care is needed to prevent clogging of tubes. This is easily managed by flushing the tubes every 2 hours, and BEFORE and AFTER all medications given.
b. Clogging is due to either lining of the NJFT with a build-up of tube feeds or inappropriate medications given down the tube.
c. The volume of the tube is so small that no amount of pancreatic enzymes, bicarbonate, cola, etc. is effective given every 8 hours to maintain patency for any extended period of time. Prevention of the buildup is essential to ensure a functioning tube.
d. Recommendation is for 20ml water (may use pre-filled NS syringes if labs allow) to be flushed down tube every two hours. An additional 20ml BEFORE and AFTER all medications given. The volume may be increased as patient's condition and fluid requirements dictate.

18. References

[1] Martindale RG. McClave SA. Vanek VW. et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine and American Society for Parenteral and Enteral Nutrition: Executive Summary. *Critical Care Medicine*. 2009; 37(5):1757-6.

[2] Nathens A, Neff M, Jurkovich G, Klotz P et al. Randomized, prospective trial of antioxidant supplementation in critically ill surgical patients. *Ann Surg*. 2002; 236:814-822.

[3] Moore FA, Moore EE, Kudsk KA, et al. Clinical benefits of an immune-enhancing diet for early post-injury enteral feeding. *J Trauma* 1994; 37:607-615.

[4] Labow BI, Souba WW. Glutamine-therapeutic usage and analysis of glutamine metabolism. *World J Surg* 2000; 24:1503-1513.

[5] Collier BR. Giladi A. Dossett LA. et al. Impact of High-Dose Antioxidants on Outcomes in Acutely Injured Patients. *JPEN*. 2008; 32 (4): 384-388.

Approved by CENTCOM JTTS Director and Deputy Director and CENTCOM SG

Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the Services or DoD

APPENDIX A

DIRECTIONS: The provider will DATE, TIME, and SIGN each order or set of orders recorded. Only one order is allowed per line. Nursing will list the time the new order(s) are noted and initial in the column provided. Orders completed during the shift in which they were written do not require recopying. They may be signed off, as completed, in the far right column.

ORDER NUMBER	PROVIDER: DATE, TIME, & SIGN EACH PAGE OF ORDERS
	LRMC ADULT PARENTERAL NUTRITION ORDER FORM

Date:	Time:	Service:	Allergies:

Check and complete appropriate orders, where indicated. All order amounts are PER 24 HOURS

1. Access Route: ☐Central ☐ Peripheral (must be less than 900 mOsm/liter; intended for short term use only)

2. Rate of Infusion: ☐ Infuse over 24 hours (rate determined by pharmacy, based on final volume
☐ Cyclic Infuse from _____ to _____

3. Base Formula:

Nutrients	Total Volume	Amino Acids	Dextrose (Carbohydrate, CHO)
☐ Premix Central Formula withOUT electrolytes	1000 mL	8.5% 500 mL (42.5 grams protein)	50% 500 mL (250 grams dextrose)
☐ Custom Parenteral Formulation	_____mL (not include lipids)	Please use 500 mL increments, where clinically appropriate ☐ 8.5% _____mL (42.5 grams protein/ 500 mL) ☐ 10% _____mL (50 grams protein/ 500 mL) ☐ 15% _____mL (75 grams protein/ 500 mL)	☐ 25% _____mL (125 grams dextrose/ 500 mL) ☐ 50% _____mL (125 grams dextrose/ 500 mL) ☐ 70% _____mL (125 grams dextrose/ 500 mL)

4. Lipids: 20% fat emulsion (2 kcal/mL) ☐ 500 mL ☐ 250 mL Infuse IV over 12 hours ☐ every day ☐ every __days

5. Electrolytes and Additives (per 24 hr bag)

Standard Electrolyte Package		Customized Electrolytes	Additives (per 24 hr bag)
Sodium 35mEq Potassium 20 mEq, Chloride 35mEq Acetate 29.5meq Magnesium 5 mEq Calcium 4.5mEq (Hospira TPN Lytes 20 mL) *Does not contain phosphate*	_____ packages (usual 1-2/day)	Sodium chloride _____mEq Sodium acetate _____mEq Potassium chloride _____mEq Potassium acetate _____mEq Sodium phosphate _____mMol Potassium phosphate _____mMol Magnesium sulfate _____mEq Calcium Gluconate _____mEq	☐Trace Elements 1 mL ☐ Multi-Vitamins 10 mL ☐ Ascorbic acid _____ mg ☐ Ranitidine _____mg ☐ Insulin _____units ☐ On an insulin infusion ☐ Phytonadione 10mg every Monday ☐ Other: _____

Note: maximum calcium:phosphate ratio = 50 (see reverse for calculation)

6. Additional Orders

a. Labs ☐ Baseline: basic metabolic panel (BMP), albumin, liver function panel (if not done in last 24 hours)
☐ Daily: BMP; Every other day: Calcium, magnesium, phosphate
☐ Weekly: albumin, triglycerides
☐ Blood glucose (BG) every 6 hours; discontinue if BG < 150 x 4; call MD for >150 x 2 if not ordered for insulin

b. For initial order (first bag): Please notify dietician and pharmacist, to complete patient assessment.
c. Strict I/O's, daily weight
d. Infuse total parenteral nutrition (TPN) thru a dedicated line.
e. Use an in-line filter (as per the LRMC Standard Operating Procedure)
f. For discontinuation of the TPN, cut the rate by 50% for 60 minutes, then stop (to prevent hypoglycemia)

PATIENT IDENTIFICATION	Signature Date/Time (Printed Name)

LRMC ADULT PARENTERAL NUTRITION ORDER FORM	Nursing Unit	Room No.	Bed No.	Page No. 1

MEDCOM FORM 688-R (MCHO) PREVIOUS EDITIONS ARE OBSOLETE MCEUL OP-347(rev) 2 Mar 99 MRRC apprvl, 4 Feb 99

GUIDELINES FOR ORDERING ADULT PARENTERAL NUTRITION

SUBSTRATES	KCAL SUPPLIED	COMMENTS
DEXTROSE (Carbohydrate/CHO)	3.4 kcal/one gram dextrose	CHO tolerance ranges from 2-5 mg/kg/minute. Maximum CHO utilization/tolerance average is 4 mg/kg/minute: 4 X (weight in kg) x 1.44 = grams CHO/day
AMINO ACIDS (Protein/AA)	4.0 kcal/one gram protein	6.25 gm protein per 1 gm Nitrogen. Dosage depends on degree of stress/injury, renal/liver function
LIPID (Fat)	9.0 kcal/ one gram fat (20% = 2.0 kcal/mL) (Propofol = 1.1 kcal/mL)	Not to exceed 30% of total kcals or 0.8 grams fat/kg

ADDITIVES

Electrolytes	Normal Range of Daily Requirements	Recommended Maximum per Liter
Calcium*	10-15 mEq/day (5 mEq/liter)	(up to) 10 mEq (when combined with P)
Magnesium	8-24 mEq/day (5 mEq/liter)	(up to) 15 mEq
Potassium	90-240 mEq/day (20-50 mEq/liter)	(up to) 80 mEq
Sodium	60-150 mEq/day (20-50 mEq/liter)	Wide Range
Acetate	80-120 mEq/day (30-50 mEq/liter)	Wide Range
Chloride	60-150 mEq/day (20-50 mEq/liter)	Wide Range
Phosphorus**	30-50 mMol/day (10-15 mMol/liter)	(up to) 30 mMol (when combined with Ca)

*Calcium gluconate provides approximately 5 mEq Ca/gram

**Potassium phosphate provides 0.68 mMol phosphate/1 mEq K; sodium phosphate provides 0.75 mMol phosphate/1 mEq Na

Vitamins:	One Multi-Vitamin package (10 mL) provides the following:		
	Retinol (A) 3300 units (1 mg) Ergocalciferol (D) 200 units(5 mcg) Tocopherol (E) 10 units (10 mcg) Phytonadione (K) 150 mcg	Ascorbic Acid 200 mg Riboflavin (B2) 3.6 mg Thiamine (B1) 6 mg Pyridoxine (B6) 6 mg Pantothenic acid 15mg Biotin 60 mcg	Folic acid 600 mcg Cyanocobalamin (B12) 5 mcg Niacinamide 40 mg
Trace Elements:	One dose of 1 mL should be administered daily except with renal failure and/or liver dysfunction.		
	One trace minerals package provides the following:		
	Zinc 5 mg ** Copper 1 mg Manganese 0.5 mg Chromium 10 mcg		
	Additional supplementation of trace elements may be required based upon degree of stress, injury or disease state		
	*Additional 2.0 mg Zinc/day in acute catabolism; 12.2 mg/L small bowel fluid losses; 17 mg/kg stool or ileostomy output		
	Selenium should be supplemented with long-term parenteral nutrition (60 micrograms/day).		
Regular Insulin:	It is recommended that insulin be provided on a sliding scale requirement or by an insulin drip. If added to parentral nutrition orders, it should be in amounts no less than 10 units per liter and only to the nearest 5 or 10 units per liter.		
Calcium:	**Phosphate calculation** Ca^{+2} in each liter (mEq) + [2 x PO_4 in each liter (mMol)] must be less than or equal to 50, to prevent precipitation of $CaPO_4$		

GENERAL REQUIREMENTS

	Kcals:	25-35 kcal/kg dry weight 25-30 kcal/kg dry weight for ventilated pts
	Protein:	1.0-1.5 grams protein/kg 1.5-2.0 grams protein/kg in trauma/head injury In obese pts: use IBW to calculate protein needs
	Fluid:	30-35 mL/kg

OSMOLARITY (mOsm) for PPN

CHO	mOsm/L	Protein	mOsm/L	Fat	mOsm/L
$D_{10}W$	505	AA 8.5%	890	20% lipids	260
$D_{20}W$	1010	AA 10%	1000		
$D_{30}W$	1515	AA 15%	1500		
Maximum recommended mOsm for PPN = 900mOsm/liter (maximum example: D20W 500 mL and AA 8.5% 500 mL)					

FORMULA SELECTION:

A. Impact with Glutamine:

1. Patients sustaining major trauma receive immune-enhancing diet for 10 days (except BURN patients):
2. Non-trauma patients whom the attending surgeon believes to be at risk for major septic morbidity, e.g.,
   a. Moderately malnourished patients (pre-albumin < 15 gm/dl) undergoing major elective procedures of the esophagus, stomach, pancreas (with or without duodenum), hepatobiliary tree or abdominal-perineal resection.
   b. Severely malnourished patients (pre-albumin <10 gm/dl) undergoing colonic resection
3. Prolonged starvation > 6days
4. High output distal colonic fistula

B. Elemental Formulas: Patients who have:

1. Proven intolerance to the first formula used
2. All burn patients.
3. Persistent, severe diarrhea > 48hrs
4. Pancreatic or duodenal injury
5. Moderate distention > 24hrs
6. Short bowel syndrome
7. At the discretion of the attending physician.

C. Polymeric Formula: Patients who do not meet the criteria for immune-enhancing diets but have normal digestive and absorptive capacity of the GI tract

D. Total Parenteral Nutrition: Indications include:

1. Massive small bowel resection refractory to enteral feeds
2. High output fistula after failure of elemental diet
3. Unable to meet >60% needs enterally by ICU day #7.

ENTERAL NUTRITION PROTOCOL POCKET REFERENCE GUIDE

Formula		Kcal/ml	Gms protein/L
Immune-enhancing	(Impact Glutamine)	1.3	78
Elemental Immune-Enhancing	(Optimental)	1.0	51.3
Polymeric with fiber	(Jevity 1 cal)	1.06	44.3
Polymeric iso-osmolar	(Osmolite 1.2)	1.2	55.5

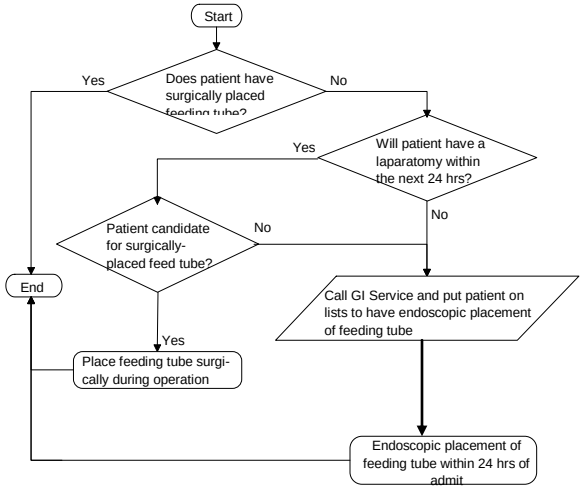
ENERGY/PROTEIN REQUIREMENTS

Kcals (total)	30-35 kcal/kg dry weight for stress/trauma/burns 25-30 kcal/kg dry weight for ventilated pts 15-20 kcal/kg actual weight for obese pts
Protein	1.0-1.5 grams protein/kg 1.5-2.0 grams protein/kg in trauma/head injury/burns In obese pts: use IBW to calculate protein needs

FEEDING PROTOCOL

- Start Glutamine per guideline upon admission to the ICU
- After resuscitation complete, start full strength formula at 20 ml/hr advance as follows:
  - Increase by 20 ml/hr every 8 hours until the targeted goal is reached.
  - In burn/head trauma patients with no abdominal injury, increase every 4 hours until the targeted goal is reached.
  - Do not stop enteral feedings for procedures to include trips to OR, CT scanner or AE (for tubes inserted beyond the ligament of Treitz).

OBTAINING ENTERAL ACCESS



GLUTAMINE GUIDELINES – BEGIN ON ADMISSION TO ICU

- Glutasolve is a powder glutamine supplement that contains 15gms glutamine per packet
- Dose 0.5 grams glutamine/kg actual weight or estimated dry wt daily x 10 days after admission to ICU.
  - Start ASAP after admission.
  - Usual dose:
    - <80kg patient – Glutasolve 1 packet 2 times daily
    - >80kg patient – Glutasolve 1 packet three times daily

  until enteral feeding goal rate achieved; then decrease Glutasolve per nutritional consult recommendations
- Mix in 120 ml sterile warm water and bolus per OG
- Stop in ARF patients with sCr>3.0 mg/dl who are not receiving dialysis or in patients with total bilirubin > 10mg/Dl
- Stop once enteral access removed.

MANAGING INTOLERANCE			
Indicator	**Severity**	**Definition**	**Treatment**
Vomiting	(Occurrence)	Any	• If no OG then place OG and start intermittent low wall suction • Check existing OG function/placement • IF OG placement correct, decrease TF infusion rate by 50% and call MD
Abdominal distention and/or cramping or tenderness (if detectable)	Mild	History and/or Physical exam	• Maintain TF infusion rate
	Moderate	History and/or Physical exam	• Maintain TF infusion. Do not advance • Order AP supine KUB x-ray • assess for small bowel obstruction If moderate distension for > 24 hrs, switch to elemental formula
	Severe	History and/or Physical exam	• Stop TF infusion • Monitor fluid status • Consider CBC, lactate, ABG, Chem7, CT scan abdomen • Check bladder pressure
Diarrhea	Mild	1-2 x /24 hr or 200-400 ml/24 hr	• Increase TF infusion rate per protocol
	Moderate	3-4 x / 24 hr or 400-600 ml/24 hr	• Maintain TF infusion rate. Do not advance • Check for c. diff in 3 sequential stools
	Severe	>4 x / 24 hr or >600 ml / 24 hr	• Decrease TF infusion rate by 50% • Review MAR: note antibiotic, bowel regimen, prokinetics, elixirs • Send stool for c. diff toxin assay in 3 sequential stools • If c. diff positive then treat with flagyl and hold antidiarrheals for 48 hrs. • If c.diff negative give 2 mg loperamide after each loose stool • Order AP supine KUB x-ray to evaluate location of feeding tube • Consider switching to elemental formula • Monitor fluid and electrolyte status
High NG output	(measured)	>1200 ml / 12 hr	• Stop TF • Order AP supine KUB to evaluate location of OG and feeding tube o If OG past pylorus, pull back into stomach and resume tube feeds @ previous rate o If NJ in the stomach, consult GI to replace o If both tubes in correct position, decrease tube feed rate by 50% assess patient entirely • Check OG aspirate for glucose by lab o if glucose >110, hold TF, reassess in 12 hours o If OG aspirate glucose negative, resume TF at 50% previous rate
Medication Considerations	Inotropic agents e.g. Dobutamine, Milrinone		• Advance feeding per protocol
	Paralytics and vasoactive agents any paralytic continuous infusion, vasopressin >0.04units/min Dopamine > 10mcg/kg/min, Norepinephrine > 5mcg/min Phenylephrine > 50mcg/min, any epinephrine		• Elemental formula at 20mL/hr. Do not advance • Continue Glutasolve, hold Prostat. • Consider concurrent TPN starting ICU day #7

APPENDIX B

ADDITIONAL INFORMATION REGARDING OFF-LABEL USES IN CPGs

A. Purpose.

The purpose of this Appendix is to ensure an understanding of DoD policy and practice regarding inclusion in CPGs of "off-label" uses of U.S. Food and Drug Administration (FDA)–approved products. This applies to off-label uses with patients who are armed forces members.

B. Background.

Unapproved (i.e., "off-label") uses of FDA-approved products are extremely common in American medicine and are usually not subject to any special regulations. However, under Federal law, in some circumstances, unapproved uses of approved drugs are subject to FDA regulations governing "investigational new drugs." These circumstances include such uses as part of clinical trials, and in the military context, command required, unapproved uses. Some command requested unapproved uses may also be subject to special regulations.

C. Additional Information Regarding Off-Label Uses in CPGs.

The inclusion in CPGs of off-label uses is not a clinical trial, nor is it a command request or requirement. Further, it does not imply that the Military Health System requires that use by DoD health care practitioners or considers it to be the "standard of care." Rather, the inclusion in CPGs of off-label uses is to inform the clinical judgment of the responsible health care practitioner by providing information regarding potential risks and benefits of treatment alternatives. The decision is for the clinical judgment of the responsible health care practitioner within the practitioner-patient relationship.

D. Additional Procedures.

1. Balanced Discussion. Consistent with this purpose, CPG discussions of off-label uses specifically state that they are uses not approved by the FDA. Further, such discussions are balanced in the presentation of appropriate clinical study data, including any such data that suggest caution in the use of the product and specifically including any FDA-issued warnings.

2. Quality Assurance Monitoring. With respect to such off-label uses, DoD procedure is to maintain a regular system of quality assurance monitoring of outcomes and known potential adverse events. For this reason, the importance of accurate clinical records is underscored.

3. Information to Patients. Good clinical practice includes the provision of appropriate information to patients. Each CPG discussing an unusual off-label use will address the issue of information to patients. When practicable, consideration will be given to including in an appendix an appropriate information sheet for distribution to patients, whether before or after use of the product. Information to patients should address in plain language: a) that the use is not approved by the FDA; b) the reasons why a DoD health care practitioner would decide to use the product for this purpose; and c) the potential risks associated with such use.