Update on the A.S.P.E.N. Guidelines for Provision of Adult Parenteral Nutrition

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Financial Disclosures

• The speaker for this presentation has no financial disclosures to make
Learning Objectives

1. Describe the necessity of prescriber education relating to adult parenteral nutrition (PN) support; and, how the use of A.S.P.E.N. guidelines are utilized to promote overall outcomes related to PN therapy.

2. Identify patients whom parenteral nutrition is indicated, and work up a basic nutritional assessment for patients receiving parenteral nutrition.

3. Assess the need for peripheral parenteral nutrition (PPN) vs total parenteral nutrition (TPN), along with the solution concentration limitations and necessary IV access.

4. Formulate nutrition goals, and incorporate them onto a standard order form, to include provision of daily kcals, protein, fluid, and electrolytes; as well as, proper compounding, labeling, and storage of the parenteral product.

5. Evaluate, manage, and adjust TPN formulas in accordance with the current guidelines and safe practices.
Recent Guidelines


• Provides evidence-based guidance related to PN (parenteral nutrition) support
• Presented in question format
• Uses **GRADE** (Grades of Recommendation, Assessment, Development, Evaluation) system of review
  • Recommendations are stated; then, rated as Weak or Strong based on supporting clinical data (i.e. **Strong** grade is associated with large, randomized, controlled clinical trials; **Weak** grade is associated with controlled observational studies)
Cont.

• 2014 A.S.P.E.N. Parenteral Nutrition Safety Consensus Recommendations
  
  • Taskforce of 46 key stakeholders created to attempt to answer questions about PN safety; and, to identify processes to improve overall prescribing, compounding, and delivery of PN

  • Presented in question format

  • Divided into 4 sections
    • Prescribing, Verification, Compounding, and Administration

  • Terminology of consensus statements expressed as “Shall”, “Should”, “May”, where “Shall” indicates that the recommendation is to be strictly followed, “Should” indicates a particular practice is preferred but not required, and “May” indicates that the practice is acceptable within the limits of the recommended practice.
Cont.

  - Assesses clinical outcomes related to nutrition in obese patients; as well as, predictive equations used for estimating energy requirements for obese patients.
  - Uses GRADE system to evaluate

- 2013 Clinical Guidelines: Nutrition Support of Adult Patients With Hyperglycemia
  - Provides guidelines for the desired blood glucose goal range in hospitalized patients; and, defines hypoglycemia
  - Poses questions and answers with consensus recommendations
  - Uses GRADE system to evaluate
Cont.

• 2011 A.S.P.E.N. Clinical Guidelines: Nutrition Screening, Assessment, and Intervention in Adults
  • Addresses recommended screening/assessment tools, nutrition risk, and appropriate time of intervention.
  • Utilizes grading system with associated levels of evidence
    • ex. Grade A (Supported by at least two level I investigations)
      Large randomized trials with clear-cut results

• 2010 A.S.P.E.N. Clinical Guidelines: Nutrition Support in Adult Acute and Chronic Renal Failure
  • Evaluated the evidence underlying the provision of nutrition support to patients with AKI (acute kidney injury) and CKD (chronic kidney disease)
  • Utilizes Grading system with associated levels of evidence
Cont.

  - Experts on the Guidelines Committees from both societies compiled a list of guidelines
  - Uses grade assessment based on level of evidence
  - Addresses timing of EN (enteral nutrition) and PN initiation, EN and PN appropriateness, EN variety, hypocaloric feeding, and blood glucose monitoring in the ICU among other issues (primarily relating to EN).

- **Honorable mention:**
“..TPN per Pharmacy…”

- Break time!
- How many kcals/kg?
- Didn’t I learn this in school?
- Where do I find the latest guidelines?
- Isn’t there a handbook on this?
- OK..where do I start?
- What about those electrolytes?
- Clinimix?
- TPN or PPN?
- I know what my next CE will be
- How many kcals/kg?
- Don’t we have some guy that does this?
- I Haven’t done this in 3 years...
- Where’s the dietician?
- CVL?
- Custom compound?
- TPN or PPN?
- Gm/Day or Final Conc?
- Volume, rate?
- Turn down for what?
- Standard order form?
- HELP!
- Insulin?
- I've got this!
- Standard order form?
- Standard order form?
- Standard order form?
- Standard order form?
What do you call a deer with no eyes?

NO EYE DEAR
Case in Point......

- MT is a 67 y.o. male to begin TPN secondary to S.B.O. (small bowel obstruction)-Pharmacy has been consulted to begin and manage TPN

- Ht: 6’1”; Current Wt: 270lbs (123)kg; admit Wt: 265lbs (120kg) ; “usual” Wt: 288lbs (131kg)

- Allergies: NKA

- PMH: RA (advanced); HTN, Chronic back pain, DMII, CABG 6 years ago

Home medications:
hydrocodone 7.5mg/acetaminophen 325mg 2 tabs p.o. q4h prn pain;
metoprolol 25mg p.o. B.I.D., metformin 500mg p.o. B.I.D. , methotrexate 5mg p.o. every 7 days, acetaminophen 500mg 2tabs q8prn joint pain
Hospital medication profile:

D5NS @ 75mL/hr, promethazine 25mg I.M. q6h prn nausea/vomiting, morphine sulfate 1mg IV/IM q4hr prn mild pain; SS Insulin protocol (q6h accu-check); hydralazine 10mg I.V. q30min prn SBP>150

No home medications continued (pt. is NPO)

• Labs: Na=135, K=3.5, Cl=100, CO2=26, BUN=22, Scr=1, Bld Glucose=287, Ca=8.9, Mg=2.3, PO4=3.5, Albumin=2.9, Pre-Albumin=8, TG=200, AST=40, ALT=35, Alk Phos=50, WBC= 8, Hgb=13, HCT=39%; Triglyceride=102

• Vital Signs: BP 129/89, HR 66, Temp 98°F, Pain Scale 6/10, RR 14
Guidelines in practice

• Perhaps some education is in order....
  • Question #1; 2014 Guidelines: “Does education of prescribers improve PN ordering?”
    • Recommendation:
      “We suggest providing education to healthcare professionals to improve PN ordering, thereby reducing errors.”
    • GRADE: Weak
  • Rationale:
    Supporting evidence involved small studies investigating compliance with A.S.P.E.N. ordering guidelines, reducing prescriber error rates, utilizing order forms, and reducing the incidence of overfeeding
• 2014 Safety Consensus Recommendations:
  • Question: Prescribing 5 (P5);
    “How can education be provided to non-nutrition support specialist clinicians to improve PN prescribing and safety?”
  • Recommendations:
    1. “Prescribers from all disciplines, including physicians....pharmacists.....and dieticians, should be educated on basic PN prescribing and monitoring.”
    2. “Introductory didactic and experiential education/training about PN should be included in the core curriculum....knowledge and skills should be evaluated for all clinicians....as determined by the individual institution. Education and assessment materials and processes shall be developed and led by clinicians with expertise in the area of nutrition support, preferably from multiple disciplines”
    3. “In-depth education of PN should be included as a standard component of acute care and home care pharmacy and physician residency training. This is also applicable to all pharmacists, nurses, dieticians, physicians, physician extenders, and other clinicians involved in caring for patients who receive PN.”
Rationale:

• Limited studies that evaluate the impact of safe prescribing education programs on the outcomes of patients receiving PN.
• Errors have been reduced via interdisciplinary teams applying education as an overall quality intervention.
• Safe prescribing should be included in the core curricula of professional programs (pharmacy included) for all who may be involved in PN prescribing.
Looking at our patient.....

• What’s our approach?
  (we will put guideline recommendation #1 into practice throughout this presentation....I hope)

General Questions to ask ourselves

- Why PN? (i.e. indication)
- What type of access does the patient have (PPN vs TPN)?
- Expected PN duration?
- Do we have a nutritional assessment?
- What are our goals, and how do we translate them into a PN order/product?
- What’s the best method for delivery (Compounding/premixed)?
- What/how do we monitor and adjust?
PN Indications

• 2014 A.S.P.E.N. Parenteral Nutrition Safety Consensus Recommendations:
  • Question: Prescribing 1-2 (P1-P2)
    • “....(P2)What are the essential elements of a PN order that minimize errors?”
  • Recommendation:
    • 2. (a) “The patient shall have an appropriate indication for PN therapy based on published guidelines and evidence for the use of PN, which shall be documented in the medical record.”
PN Indications

- Bowel Obstruction (our patient)

- Non-functioning GI tract
  - Ex: post-op ileus

- Failed Tube Feeding (TF)
  - Increased/prolonged residuals (>400ml)

- Gastrointestinal disorders
  - IBD, Crohn’s/UC exacerbation
  - Malabsorption, intractable nausea/vomiting/diarrhea
  - Fistulas

- 2009 Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient
  - Malnourished patients undergoing major upper GI surgery
    - Initiate 5-7 days preoperatively into the postoperative period
    - Unable to tolerate EN (enteral nutrition)

- Remember the old rule of thumb: “if the gut works, use it!”
I.V. Access

• What about MT (our patient)?
  Does he have central I.V. access?

• Central access necessary for TPN (TNA)
  • Line must end in superior vena cava

• 2014 Safety Consensus Recommendations (specific to IV access):
  Question: Administration 3 (A3)
  “What practices maintain patient safety during the infusion of PN?”
  • Specific recommendation:
    2. “Organizations **shall** establish evidence-based policies to
       guide the selection, insertion, care, and maintenance of VADs
       used to administer PN.”

• Rationale:
  “Reliable vascular access is essential for safe and effective delivery of
  PN......VAD’s are a leading cause of serious adverse complications
  related to PN therapy, in particular central line-associated bloodstream
  infection (CLABSI)....”
What about peripheral access?

- PN can be safely infused via peripheral line (PPN) if..........

- Let’s return to the 2014 Clinical Guidelines:
  - Question #2: “What is the maximum safe osmolarity of PN admixtures intended for peripheral vein administration?”
    - Recommendation: “We suggest that PN with an osmolarity of up to 900 mOsm/L can be safely infused peripherally.”
    - GRADE: Weak
    - Rationale: PPN limited by tolerance to the concentrated macronutrient formula and high fluid volumes. Thrombophlebitis is the main side effect associated with PPN infusion.
Cont.

- Dextrose, Amino Acid main contributors to osmolarity
  - Max 10% Dextrose conc.
  - Max 3% Amino Acid conc.
  - Lipids contribute very little to osmolarity
- Need to assess vein patency
  - Mid-line O.K. (but not for central PN)
- PPN only recommended up to 5-7 days

Take home message:

****NEVER INFUSE TPN SOLUTIONS VIA PERIPHERAL VEIN****
Nutrition Assessment

• Defined by A.S.P.E.N. as “a comprehensive approach to diagnosing nutrition problems that uses a combination of the following: medical, nutrition, and medication histories, physical examination, anthropometric measurements, and laboratory data.”

• The Joint Commission mandates nutrition screening within 24 hours of admission to an acute care center
  • Usually done by the clinical dietician
    • Most common assessment tool: Subjective Global Assessment (SGA)
Nutrition Assessment

What’s in the guidelines?

- Nothing specifically addresses nutrition assessment in the 2014 guidelines/recommendations (other than education of prescribers)
- 2011 A.S.P.E.N. Guidelines for Nutrition Screening, Assessment, and Intervention in adults:

Table 4. Nutrition Support Guideline Recommendations in Adult Nutrition Screening and Assessment

<table>
<thead>
<tr>
<th>Guideline Recommendations</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Screening for nutrition risk is suggested for hospitalized patients.</td>
<td>E</td>
</tr>
<tr>
<td>2. Nutrition assessment is suggested for all patients who are identified to be at nutrition risk by nutrition screening.</td>
<td>E</td>
</tr>
<tr>
<td>3. Nutrition support intervention is recommended for patients identified by screening and assessment as at risk for malnutrition or malnourished.</td>
<td>C</td>
</tr>
</tbody>
</table>

### Table 1. Selected Nutrition Screening and Assessment Instrument Parameters

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Anthropometry and/or Diet-Related</th>
<th>Severity of Illness</th>
<th>Other (Physical, Psychological Variables or Symptoms)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screening tools</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birmingham Nutrition Risk Score¹³</td>
<td>Weight loss, BMI, appetite, ability to eat</td>
<td>Stress factor, (severity of diagnosis)</td>
<td></td>
</tr>
<tr>
<td>Malnutrition Screening Tool¹⁴</td>
<td>Appetite, unintentional weight loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malnutrition Universal Screening Tool¹⁵</td>
<td>BMI, change in weight</td>
<td>Presence of acute disease</td>
<td></td>
</tr>
<tr>
<td>Maastricht Index¹⁶</td>
<td>Percentage ideal body weight</td>
<td>Albumin, prealbumin, lymphocyte count</td>
<td></td>
</tr>
<tr>
<td>Nutrition Risk Classification¹⁷</td>
<td>Weight loss, percentage ideal body weight, dietary intake</td>
<td></td>
<td>Gastrointestinal function</td>
</tr>
<tr>
<td>Nutritional Risk Index¹⁸</td>
<td>Present and usual body weight</td>
<td>Albumin</td>
<td></td>
</tr>
<tr>
<td>Nutritional Risk Screening 2002¹⁹</td>
<td>Weight loss, BMI, food intake</td>
<td>Diagnosis (severity)</td>
<td></td>
</tr>
<tr>
<td>Prognostic Inflammatory and Nutritional Index²⁰</td>
<td></td>
<td>Albumin, prealbumin, C-reactive protein, α1-acid glycoprotein</td>
<td></td>
</tr>
<tr>
<td>Prognostic Nutritional Index²¹</td>
<td>Triceps skin fold</td>
<td>Albumin, transferrin, skin sensitivity</td>
<td></td>
</tr>
<tr>
<td>Simple Screening Tool²²</td>
<td>BMI, percentage weight loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Nutrition Assessment Questionnaire²³</td>
<td>Recent weight history, appetite, use of oral supplement or tube feeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nutrition assessment tools</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mini Nutritional Assessment²⁴</td>
<td>Weight data, height, mid-arm circumference, calf circumference, diet history, appetite, feeding mode</td>
<td>Albumin, prealbumin, cholesterol, lymphocyte count</td>
<td>Self-perception of nutrition and health status</td>
</tr>
<tr>
<td>Subjective Global Assessment²⁵</td>
<td>Weight history, diet history</td>
<td>Primary diagnosis, stress level</td>
<td>Physical symptoms (subcutaneous fat, muscle wasting, ankle edema, sacral edema, ascites), functional capacity, gastrointestinal symptoms</td>
</tr>
</tbody>
</table>

BMI, body mass index.
What we need to know about MT (our patient)

Basics:

- **Ht:** (6’1”)
- **Wt:** Current weight, admission weight (in kg), usual body weight (Admit Wt = 265lbs (120kg))
- **Ideal Body Weight (IBW)**
  - 2.3(inches>5ft)+ 50 (males)
  - 2.3(inches>5ft)+45.5(females)

  **IBW for MT = 80kg**

- **BMI (body mass index)**
  - \( \text{Wt(kg)/ Ht(m}^2) \)

  [MT’s BMI = 35kg/m\(^2\) (Obesity, class II)]
• Inquire about any unintentional weight loss (either via patient interview, or patient’s family)
  • Even in patients with high BMI, unintentional weight loss is critical to the assessment.
  • Obese patients can still be in a state of starvation

• Refeeding Syndrome?
  • Can be hard to assess; but, when in doubt, assume there is risk if patient has been NPO and/or reports unintentional weight loss

• Past medical history (looking for such issues as renal insufficiency, liver disease, diabetes, CHF, Cancers, HIV, etc.)
Cont.

• Current condition/illness
  • Look for new diagnosis of the above; and, any issues relating to fluid, GI function, etc.
  • Does the patient have bowel sounds?
  • Has TF been attempted? Is there a feeding tube in place?

• Review Medications/Fluid Status
  • Do any medications need to be discontinued
  • Dehydration
  • Edema
• Lab data
  ➢ Baseline labs
    ➢ Albumin, Pre-albumin
    ➢ Markers for nutrition
      • Negative acute phase reactants (decrease in response to inflammation)
  ➢ Triglycerides
  ➢ Blood glucose
  ➢ K, Na, Po4, Mg, Ca, CO2, Cl, BUN, Scr
  ➢ LFT’s

  ➢ (“Bonus”) labs
    ➢ CRP
    ➢ BNP
    ➢ CBC
Nutrition Goals (Guidelines)

• No guidelines in 2014 specifically address goal energy/protein requirements/amounts.

• 2009; Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient, from the Society of Critical Care Medicine and A.S.P.E.N.

• 2010 A.S.P.E.N. Clinical Guidelines: Nutrition Support in Adult Acute and Chronic Renal Failure

• Good reference?
  • A.S.P.E.N. Adult Nutrition Support Core Curriculum 2nd Edition
    ➢ textbook
• **Predictive Equations:**
  - Weight based equations (kcals/kg)
    - A.S.P.E.N. guideline: 20-35kcals/kg daily for adults
      - Initial assessment: 25kcals/kg daily (often use 30kcals/kg)

• **Weight** a minute............
  - What weight is used to calculate?
    - **BMI < 30;** use actual body weight (pre-admission wt.) and calculate as above.
    - **BMI > 30;** use actual body weight; but, reduce estimate to 11-14kcals/kg/day –OR- use IBW and calculate as above (i.e. 25kcals/kg/day)
    - If patient is underweight; use actual body weight
      - We’ll come back to this in later discussion
Cont.

• Other options:
  • **Harris-Benedict Equations:**
    • BEE Men = 66 + (13.7 x Wt kg) + (5.0 x Ht cm) – (6.8 x Age (yrs))
    • BEE Women = 655 + (9.6 x Wt kg) + (1.7 x Ht cm ) – (4.7 x Age (yrs))

  • Use of this equation is declining (better methods have proven to be a more accurate predictor of RMR)
  • Most of us learned this equation in school; some facilities still utilize
  • Must determine stress factor

• **Mifflin St. Jeor Equation**
  • (men) = 10(wt. in kg)+ 6.25(ht. in cm)- 5(age)+ 5
  • (women)= 10(wt. in kg)+6.25(ht. in cm)-5(age)- 161

  • Thought to be more useful for estimating RMR in obese patients; however, can be a predictor for both obese and non-obese patients.
  • Non-critically Ill
• Penn State Equations:
  - Penn State (kcals/day) = Mifflin (0.96) + V_E (32) + T_m (167) - 6212
    - V_E = minute ventilation (L/min), T_m = max body temp in 24hrs (centigrade)

  - Penn State Equation (modified; pt’s >60yrs and BMI>30)
    = Mifflin (0.71) + V_E (64) + T_m (85) - 3085
    - V_E = minute ventilation (L/min), T_m = max body temp in 24hrs (centigrade)

• Used in ventilated critically ill patients
• Currently recommended as the more accurate predictor of RMR
  - 2013: A.S.P.E.N. Clinical Guidelines: Nutrition Support of Hospitalized Adult Patients With Obesity (see next slide)
<table>
<thead>
<tr>
<th>Question</th>
<th>Recommendation</th>
<th>Recommendation Grade and Evidence Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do clinical outcomes vary across levels of obesity in critically ill or hospitalized non-ICU patients?</td>
<td>1a. Critically ill patients with obesity experience more complications than patients with optimal BMI levels. Nutrition assessment and development of a nutrition support plan is recommended within 48 hours of ICU admission.</td>
<td>Recommendation: Strong Evidence: Low</td>
</tr>
<tr>
<td></td>
<td>1b. All hospitalized patients, regardless of BMI, should be screened for nutrition risk within 48 hours of admission, with nutrition assessment for patients who are considered at risk.</td>
<td>Recommendation: Strong Evidence: Low</td>
</tr>
<tr>
<td>2. How should energy requirements be determined in obese critically ill or hospitalized non-ICU patients?</td>
<td>2a. In the critically ill obese patient, if indirect calorimetry is unavailable, energy requirements should be based on the Penn State University 2010 predictive equation, or the modified Penn State equation if the patient is over the age of 60 years.</td>
<td>Recommendation: Strong Evidence: High</td>
</tr>
<tr>
<td></td>
<td>2b. In the hospitalized obese patient, if indirect calorimetry is unavailable and the Penn State University equations cannot be used, energy requirements may be based on the Mifflin–St Jeor equation using actual body weight.</td>
<td>Recommendation: Weak Evidence: Moderate</td>
</tr>
<tr>
<td>3. Are clinical outcomes improved with hypocaloric, high protein diets in hospitalized patients with obesity?</td>
<td>3a. Clinical outcomes are at least equivalent in patients supported with high protein, hypocaloric feeding to those supported with high protein, eucaloric feeding. A trial of hypocaloric, high protein feeding is suggested in patients who do not have severe renal or hepatic dysfunction. Hypocaloric feeding may be started with 50%-70% of estimated energy needs or &lt; 14 kcal/kg actual weight. High protein feeding may be started with 1.2 g/kg actual weight or 2-2.5 g/kg ideal body weight, with adjustment of goal protein intake by the results of nitrogen balance studies.</td>
<td>Recommendation: Weak Evidence: Low</td>
</tr>
<tr>
<td></td>
<td>3b. Hypocaloric, low protein feedings are associated with unfavorable outcomes. Clinical vigilance for adequate protein provision is suggested in patients who do not have severe renal or hepatic dysfunction.</td>
<td>Recommendation: Weak Evidence: Low</td>
</tr>
<tr>
<td>4. In obese patients who have had a malabsorptive or restrictive surgical procedure, what micronutrients should be evaluated?</td>
<td>4. Patients who have undergone sleeve gastrectomy, gastric bypass, or biliopancreatic diversion ± duodenal switch have increased risk of nutrient deficiency. In acutely ill hospitalized patients with history of these procedures, evaluation for evidence of depletion of iron, copper, zinc, selenium, thiamine, folate, and vitamins B₁₂ and D is suggested as well as repletion of deficiency states.</td>
<td>Recommendation: Weak Evidence: Low</td>
</tr>
</tbody>
</table>

ICU, intensive care unit.
Indirect Calorimetry (metabolic cart study)
- Measures $VCO_2$, $VO_2$ exchange, RQ (respiratory quotient)
- Most accurate measure of REE (resting energy expenditure)

- Not available at most institutions
  - Expensive
  - Requires respiratory therapist
    - Labor intensive
What about MT?

- Age 67; male
- \( \text{Wt}=265\text{ lbs (120kg); Ht}=6'1''(73\text{ inches}) \)
- \( \text{BMI}=35\text{ kg/m}^2 \) (Obesity Class II)
- \( \text{IBW}=2.3(13) + 50 = 80\text{kg} \)

**Estimated REE:**

11-14kcals/kg/day (Actual Body Wt) = \( 1320-1680\text{kcals/day} \)

25kcals/kg/day (IBW) = \( 2000\text{kcals/day} \)

Mifflin St. Jeor Equation: \( 2028\text{kcals/day} \)

Penn Sate: Not applicable for non-critically ill patients
How to determine macronutrients

- **Protein**
  - Standard solution recommended (aromatic AA)
  - General Protein Guideline
    - RDA=0.8g/kg/day
    - Usual amount for PN therapy
      - 1.5-2gm/kg/day
        (typically use 1.5gm/day)
  - Renal insufficiency
    - 0.6-0.8gm/kg initially (predialysis)
    - 1.2-1.3gm/kg initially (PD, HD)
      - Up to 1.5-1.8gm/kg
      - CRRT: up to 2.5gm/kg
  - Hepatic insufficiency
    - 0.5-1gm/kg (Hepatic Failure with Encephalopathy)
• 2010 A.S.P.E.N. Clinical Guidelines: Nutrition Support in Adult Acute and Chronic Renal Failure

368 Journal of Parenteral and Enteral Nutrition / Vol. 34, No. 4, July 2010

<table>
<thead>
<tr>
<th>Guidelines Recommendation</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Patients with renal disease should undergo formal nutrition assessment, including evaluation of inflammation,</td>
<td>D</td>
</tr>
<tr>
<td>with development of a nutrition care plan.</td>
<td></td>
</tr>
<tr>
<td>2. Standard amino acid parenteral nutrition formulations should be used in acute kidney injury.</td>
<td>C</td>
</tr>
<tr>
<td>3. Intradialytic parenteral nutrition should not be used as a nutritional supplement in malnourished chronic kidney disease-V hemodialysis patients.</td>
<td>C</td>
</tr>
<tr>
<td>4. Patients with renal failure who require nutrition support therapy should receive enteral nutrition if intestinal function permits.</td>
<td>E</td>
</tr>
<tr>
<td>5. Energy requirements in patients with renal disease should be evaluated using indirect calorimetry when possible.</td>
<td>D</td>
</tr>
<tr>
<td>If indirect calorimetry is not possible, individualized assessment of energy intake goals, as with other nutrition support patients, is recommended.</td>
<td></td>
</tr>
<tr>
<td>6. To promote positive nitrogen balance in patients with acute kidney injury, protein intake should be adjusted according to catabolic rate, renal function, and dialysis losses.</td>
<td>D</td>
</tr>
<tr>
<td>7. Electrolyte intake in patients should be adjusted by monitoring serum concentrations of K, Mg, P, and Ca.</td>
<td>D</td>
</tr>
</tbody>
</table>

• What about obesity?
  • Refer back to 2013 Guidelines for adult obese patients
  • 1.2gm/kg actual wt. -or- 2-2.5gm/kg IBW, using nitrogen balance study analysis for adjustment
    • AA provides 1gmN₂/6.25gmAA
    • N₂ Balance= (N₂ in – N₂ out)+ 4 (“insensible” losses)
      • Goal (+)= 3-4gm N₂

• Provides 4kcals/gm

• MT would need approx. 144gm (1.2gm/kg ABW) – 160gm (2gm/kg IBW) of protein
  • (No renal issues)
• General CHO guidelines:
  • Recommended glucose infusion rate
    • Maximum of 4mg/kg/min
    • 1-2mg/kg/min good starting point
    • 60% - 70% of non-protein calories (common practice)
      • For our patient MT: 115-230gm CHO = 391-782kcals
    • Provides 3.4kcal/gm
  • What about Blood Glucose levels.....?
• 2013 Clinical Guidelines: Nutrition Support of Adult Patients With Hyperglycemia
• **Question #1.** What is the desired blood glucose range in adult hospitalized patients receiving nutrition support?
  • **Recommendation:**
    
    “We recommend a target blood glucose goal range of 140-180 mg/dl (7.8-10mmol/L).”
    
    GRADE: Strong
  
  • **Rationale:**
    • During the early 2000’s, studies lead to the consensus to recommend BG levels be maintained below 110.
    • Later studies failed to show benefit of this aggressive BG goal
    • Large, randomized controlled trial found a higher mortality in patients treated with intensive treatment compared with those treated to target blood glucose range of 140-180mg/dL (7.8-10mmol/L)
    • No trials have compared a broader range of 110-180mg/dL (6.1-10mmol/L) to intensive treatment.
Cont.

- **Question #2.** How is hypoglycemia defined in adult hospitalized patients receiving nutrition support?
  - **Recommendation:**
    - We recommend that hypoglycemia be defined as a blood glucose concentration of <70mg/dL (<3.9mmol/L).
    - GRADE: Strong
  - **Rationale:**
    - Hypoglycemia is associated with adverse outcomes in hospitalized patients.
    - Symptoms can be missed in hospitalized patients who are sedated/ventilated.
    - Counter regulatory hormone release occurs at BG<70 mg/dL.
    - Setting lower thresholds (i.e. <40mg/dL) increases error rates associated with point-of-care testing in hospitalized patients.
• General Lipid provision guidelines:
  • Up to 1gm/kg considered safe
  • Provides 9kcals/gm (often use 10kcals/gm)
    -OR-
    • 10% IVFE (1.1kcal/ml)
    • 20% IVFE (2kcal/ml)
    • 30% IVFE (3kcal/ml)
  • Can be added with AA and CHO (TPN); or infused separately.
2014 Clinical Guidelines:

Question #12. “What beyond-use date (BUD) should be used for (a) IVFE dispensed for separate infusion in the original container and (b) repackaged IVFE?”

(a) We recommend that the BUD for unspiked IVFE in the original container should be based on the manufacturer’s provided information. The BUD for IVFE in the original container spiked for infusion should be 12-24h.”

(b) Although repackaged IVFE is not recommended, when used, the BUD for IVFE transferred from the original container to another container for infusion separately from a 2-in-1 PN solution should be 12 h.”

GRADE: Strong
Cont.

• **Rationale:**

  • BUD is the point in time after which a CSP (compounded sterile preparation) shall not be stored or transported.
  
  • BUD, for spiked IVFE used to compound TNA is defined by USP Chapter <797> as a moderate-level risk preparation, is defined as 30 hours at room temperature and 9 days refrigerated.
  
  • IVFE transferred from the original container to a secondary container is considered a Low-Level risk CSP, defined as 48 hours at room temperature and 14 days refrigerated.
What is the best *initial* Kcal/day goal for MT?

a. 1300kcals
b. 1500kcals
c. 1800kcals
d. 2000kcals
e. Any of the above
f. All of the above
• Here’s where we are “all over the map”
  • Our estimated range: approx. 1300-2000Kcals
    • Remember: we estimated kcals via Mifflin equation,
      11-14kcals/kg/day ABW –or- 25kcals/kg/day IBW due to obesity
  • Refeeding risk?
    • Possible
      • Wt. loss, NPO
  • **Professional judgment** (there’s really no “wrong” answer to our pop quiz; however, one could argue that 2000kcals may be a lofty initial goal)
    • Let’s pick 1500kcals as our initial goal
    • Trust your **GUT**!
• Break down your kcal components:
  • **AA 140gm** = 560 kcals
  • Subtract protein kcals from our goal of **1500 kcals**
    • Common practice is to use a 60:40 or 70:30 CHO:Lipid ratio to determine non-protein kcals
      • Ex: **1500 kcals (total) - 560 kcals (protein) = 940 non-protein kcals**
        • .60 x 940 = 564 kcals (**165Gm**) CHO
        • .40 x 940 = 376 kcals (**42Gm**) Lipid
  • Using CHO infusion rate of 1-2 mg/kg/min:
    • **115-230 gm CHO**
    • Simply choose your CHO amount and subtract kcals from the total non-protein kcals to determine lipid amount
      • Ex: **200 gm CHO (680 kcals); 940 kcals - 680 kcals = 260 kcals (~30Gm) Lipid**
Volume?

- Adult fluid requirements are approx. 30ml/kg/day (similar to est. kcals/day)
  - Assess for any reasons that patient requires fluid restriction
    - CHF, Renal Insufficiency, Edema, etc.
  - What IVF’s are going?
    - D5NS @ 75ml/hr
  - A reasonable fluid goal for MT:
    - 1500-2000ml
    - 3000ml seems a little high (120kg x 30); Use Clinical Judgment
Writing the Order

• What method of PN are we going to choose to administer our estimated goals?
  • Custom Compounded
    • 2-in-1 vs 3-in-1
  • Pre-Mix AA/CHO
    • With/without electrolyte

• What’s recommended.....?
2014 Clinical Guidelines:

Question #4: What are the clinical advantages or disadvantages of commercially available premade (“premixed”) multi-chambered PN formulations compared with compounded PN formulations?

Recommendation:

“We suggest that commercially available premade multichamber PN formulations be considered as an available option for patients alongside compounded (customized or standard) PN formulations to best meet an organization’s patient needs.”

GRADE: Weak
• 2014 Safety Recommendations: *Compounding 4 (C4).*

What role does United States Pharmacopeia (USP) Chapter <797> play in preventing PN errors?

*Recommendations 3-4:*

3. “Standardized, commercially available PN products *may* be viable options to manually compounded sterile PN products when compliance with USP Chapter <797> and accepted guidelines from patient safety organizations is not feasible. “

4. “Healthcare organizations *shall* have policies and procedures that guide the preparation of PN admixtures.”
Cont.

- **Rationale:**
  - Hard to find literature to support clear advantages and disadvantages of each delivery method
  - Most clinical trials do not directly compare delivery methods for patient outcomes.
  - A.S.P.E.N. Consensus Recommendations determined that the basis for identifying the best delivery system should be based on the number and type of patients requiring PN
  - Clinicians often find that premixed products are unable to meet the caloric, protein, and electrolyte needs in the critically ill population
    - Obesity, fluid restriction, hepatic/renal dysfunction, etc.
• Question #5 (Guidelines): What are the clinical (infection, catheter occlusion) advantages or disadvantages of 2-in-1 compared with 3-in-1 PN admixtures?
  • Recommendation:
    “We suggest that there is no clinical difference in infectious complications between the two PN delivery systems; 3-in-1 formulations administered in the homecare setting may increase the risk for catheter occlusion and shorten catheter lifespan.”
  • GRADE: Weak
Cont.

• **Rationale:**
  • 2-in-1 (dextrose-amino acid formulation)
    • Requires 0.22µm filter
      • Fewer particulate matter can pass through
    • IVFE infused separately
  • 3-in-1 (amino acids, dextrose, and IVFE in one container)
    • Often thought to be more cost effective
    • Requires 1.2 µm filter
      • Larger pore size can lead to more opportunity for particulate matter to enter (and/or bacteria) to enter bloodstream
      • Higher risk of emulsion destabilization from inappropriate concentrations of nutrients as well as medication/additive incompatibility with the fat component
Question #6 (Guidelines): What macronutrient dosing limits are expected to provide for the most stable 3-in-1 mixtures?

Recommendation:

“We recommend that TNA’s maintain final concentrations of amino acid $>4\%$, monohydrated dextrose $>10\%$, and injectable lipid emulsion $>2\%$ to be more likely to remain stable for up to 30 h at room temperature ($25^\circ C$) or for 9 d refrigerated ($5^\circ C$) followed by 24 h at room temperature.”

GRADE: Strong
• **Rationale:**
  - 3-in-1 (TNA) solutions are commonly used in the hospital and home environments.
    - High potential for instability due to chemical and physicochemical interactions
  - **Lipid stability**
    - Determined by pH, temperature, free fatty acid concentrations, and lipid globule size
    - Cracking likely to occur in TNA solutions where >0.4% of its total fat concentration present as particles > 5µm
      - Visual evidence seen as free oil droplets at the surface of the formulation
  - **Monovalent, divalent, and trivalent cations affect stability**
    - At the recommended final concentrations, stability is maximized
    - Iron Dextran (trivalent, ferric ions) incompatible in TNA due to the high potential of instability.
  - **Amino acids provide a buffer**
  - **Dextrose decreases pH**
How about MT?

- We have choices for PN delivery.
  - What’s the best option for MT?
  - 3-in-1, 2-in-1, Compounded, premixed...?
Back to the drawing board....

- Any of the available options will meet MT’s initial goals.
  - Premixed option may not meet optimal protein goal; but will meet Kcal goal when IVFE infused separately
  - TNA can be custom compounded to include exact amount of base products

- Let’s go with a custom order, 3-in-1 TNA

- What’s next?
  - Electrolytes, etc.

- MT’s initial goals:
  - AA 144Gm
  - CHO 165Gm
  - Lipid 42Gm
  - Volume 1800ml
TPN Additives

• Electrolytes
  • Na, K, Ca, Mg, Phos,
    • Added individually (when available), or as a standard vial of electrolytes
• Vitamins
  • MVI (contains 150mcg Vit K)
• Trace Elements
  • Concentrated vial containing: Zn, Cu, Cr, Mn, Se
• Insulin (Regular)
  • Add if initial BG elevated and/or history of DM (approx. 0.1unit insulin/1gm CHO)
  • Follow SSI and adjust insulin using 2/3 of the total insulin given in 24hrs

• Miscellaneous (see guideline)
  • Thiamine
  • Extra Zn, Cr
  • Ascorbic Acid
  • Famotidine
What’s the latest word?

• 2014 Clinical Guidelines:
  • Question #7. What are the most appropriate recommendations for optimizing calcium (gluconate) and (Na-or K-) phosphate compatibility in PN admixtures?
    • *Recommendation:*
      “We cannot make a recommendation due to the multiple variations in amino acid concentrations, PN volume, pH, presence or absence of fat emulsion, or the amounts of other minerals (eg, magnesium). We suggest published graphs for specific products provide adequate guidance; however, no evidence indicates that these formulations remain stable for >24-48 h.”
    GRADE: Weak
• **Rationale:**
  • Calcium and phosphorous solubility depends on a number of factors
    • AA concentration
    • Temperature
    • pH
    • The mixing sequence
    • 2-in-1 vs 3-in-1
    • Amounts of Calcium and phosphate ions
    • Solubility curves are best option to determine maximum Ca/Phos additive amounts
Cont.

• Question #9 (Guidelines): Is it safe to use the PN admixture as a vehicle for non-nutrient medication delivery?
  • Recommendation:
    “We recommend that non-nutrient medication be included in PN admixtures only when supported by (1) pharmaceutical data describing physiochemical compatibility and stability of the additive medication and of the final preparation under conditions of typical use and (2) clinical data confirming the expected therapeutic actions of the medication; extrapolation beyond the parameter limits (eg, products, concentrations) of the given data is discouraged”
    GRADE: Strong

• Statements from 2014 Safety Recommendations:
  • Prescribing recommendation 4 (l.) “Prescribing a PN formulation that includes non-nutrient medications should be avoided. When no other reasonable alternatives exist, non-nutrient medications shall only be included on the PN order if data support compatibility stability.”
  • Administration Recommendation 3 (16.) “Co-Infusion of medication through PN lines shall require a review of compatibility and stability data by a pharmacist.

Short answer: We can add famotidine, insulin, etc. to PN as supported by stability data
Question # 10 (Guidelines): Should heparin be included in the PN admixture to reduce the risk of central vein thrombosis?

**Recommendation:**

“We suggest that heparin not be included in PN admixtures for reducing the risk of central vein thrombosis in adults.”

GRADE: Weak

**Rationale:**

• Thought to reduce thromboembolic complications; however, there is no evidence to support a decrease in catheter related thrombosis

• PN with IVFE stability is compromised (flocculation and creaming) because of an interaction between heparin and calcium.

• Use polyurethane vs polyethylene catheters to reduce thrombosis
• 2014 Parenteral Nutrition Safety Consensus
  • Specifically addresses prescribing, verification, and compounding recommendations
  • Of Note:
    • *Prescribing (P1-P2)*
      Recommendation 4 (h.): “All PN ingredients *shall* be ordered in amounts per day (eg, for adult patients) or amounts per kilogram per day (eg, pediatric and neonatal patients) rather than amounts per liter, percent concentrations, or volume. Amount per day refers to macronutrients in grams per day, and micronutrients in meq, mmol, mcg, or mg per day. Electrolytes *shall* be ordered as the complete salt form rather than the individual ion....”
**PARENTERAL NUTRITION (TPN/PPN) ORDER FORM**

<table>
<thead>
<tr>
<th><strong>ALL INGREDIENTS ORDERED AS AMOUNT PER 24 HOURS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PATIENT SPECIFIC SOLUTION</strong></td>
</tr>
<tr>
<td>PROTEIN</td>
</tr>
<tr>
<td>144 gM</td>
</tr>
<tr>
<td>DEXTROSE</td>
</tr>
<tr>
<td>165 gM</td>
</tr>
<tr>
<td>FAT</td>
</tr>
<tr>
<td>42 gM</td>
</tr>
<tr>
<td>BASE VOLUME PER 24 HOURS</td>
</tr>
<tr>
<td>1800 mL @ 75 mL/hr</td>
</tr>
</tbody>
</table>

**ADDITIONS**

<table>
<thead>
<tr>
<th><strong>Total Daily Electrolytes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium 70 mEq/day</td>
</tr>
<tr>
<td>Chloride 70 mEq/day</td>
</tr>
<tr>
<td>Calcium 9 mEq/day</td>
</tr>
<tr>
<td>Acetate 59 mEq/day</td>
</tr>
<tr>
<td>Magnesium 10 mEq/day</td>
</tr>
<tr>
<td>Phosphate 30 mEq/day</td>
</tr>
<tr>
<td>(46mEq as Potassium Chloride + 44mEq as Potassium Phosphate)</td>
</tr>
</tbody>
</table>

**INDIVIDUAL ADDITIVES**

<table>
<thead>
<tr>
<th>Additive</th>
<th>mEq</th>
<th>RN verify</th>
<th>RN verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium chloride</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium Phosphate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium gluconate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium sulfate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin, Regular human</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OPTIONAL ADDITIVES**

<table>
<thead>
<tr>
<th>Additive</th>
<th>mEq</th>
<th>mEq</th>
<th>RN verify</th>
<th>RN verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium acetate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium acetate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Phosphate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other**

Date: 2/22/2015

R. Breeden, PharmD

M.D.

Verified and hung by: _______________________________  R.N. Time Hung: _______________________________

Physician Signature: _______________________________
Miscellaneous:

• 2014 Safety Recommendations:

  **Summary**
  • All abbreviations shall follow The Joint Commission standards on abbreviations. *(Prescribing 1-2)*
  • Orders should be transmitted via CPOE where available; otherwise, should follow a standard template and procedure. *(Verification 1)*
  • Review for all required elements previously discussed (TPN indication, IV access, nutrition assessment, etc.). *(Verification 2)*
  • Label should reflect all the requirements (see next slide). *(Verification 3)*
### Patient Information

- **Patient Name:**
- **Medical Record Number:**
- **Birthdate/age:**
- **Patient location:**

### Height and Dosing Weight

- Height: __ cm
- Dosing Wt: __ kg

### Diagnosis(es)/Indication(s) for PN

- Location: __

### Vascular Access Device/Location

- CVC type: __

### Administration Details

- **Administration date:**
- **Administration time:**

### Macronutrients

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amino Acid*</td>
<td>g</td>
</tr>
<tr>
<td>Dextrose</td>
<td>g</td>
</tr>
<tr>
<td>IV Fat Emulsion*</td>
<td>g</td>
</tr>
</tbody>
</table>

### Electrolytes

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Phosphate</td>
<td>mmol of phosphate (Sodium __ mEq)</td>
</tr>
<tr>
<td>Sodium Chloride</td>
<td>mEq</td>
</tr>
<tr>
<td>Sodium Acetate</td>
<td>mEq</td>
</tr>
<tr>
<td>Potassium Phosphate</td>
<td>mmol of phosphate (Potassium __ mEq)</td>
</tr>
<tr>
<td>Potassium Chloride</td>
<td>mEq</td>
</tr>
<tr>
<td>Potassium Acetate</td>
<td>mEq</td>
</tr>
<tr>
<td>Magnesium Sulfate/Chloride</td>
<td>mEq</td>
</tr>
<tr>
<td>Calcium Gluconate</td>
<td>mEq</td>
</tr>
</tbody>
</table>

### Vitamins, Trace Elements

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-component Vitamins*</td>
<td>mL</td>
</tr>
<tr>
<td>Multi-component Trace Elements*</td>
<td>mL</td>
</tr>
</tbody>
</table>

### Other Additives (e.g., individual vitamins or trace elements, regular insulin)

### IV Instructions

**For Central (peripheral) Vein Administration Only**

- **Total volume:** __ mL
- **Overfill volume:** __ mL
- **Infusion rate:** __ mL/h
- **Start and Stop times:**
- **Cycle information:**
- **Do not use after date/time:**
- **Discard any unused volume after 24 hours:**

### Prescriber and Contact Information

- **Institution/Pharmacy Name:**
- **Institution/Pharmacy Address:**
- **Pharmacy Telephone number:**

---

<table>
<thead>
<tr>
<th>Patient Name</th>
<th>Medical Record Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthday/age</td>
<td></td>
</tr>
<tr>
<td>Patient location</td>
<td></td>
</tr>
<tr>
<td>Height and dosing weight: Ht: cm Dosing Wt: kg</td>
<td></td>
</tr>
<tr>
<td>Diagnosis(es)/Indication(s) for PN</td>
<td></td>
</tr>
<tr>
<td>Vascular access device/location CVC type</td>
<td>Location</td>
</tr>
<tr>
<td>Administration date</td>
<td>Administration time</td>
</tr>
<tr>
<td>Infusion Volume Amount/day</td>
<td></td>
</tr>
<tr>
<td>Intravenous fat emulsion*</td>
<td>mL        g</td>
</tr>
</tbody>
</table>

Instructions

**For Central or Peripheral Vein Administration**
- Total volume mL (may contain overfill)
- Infusion rate mL/h
- Infuse over h
- Do not use after date/time

***** Discard any unused volume after 12 hours*****

Prescriber Name/Contact Information

Institution/Pharmacy Name
Institution/Pharmacy Address
Pharmacy Phone Number

**Figure 5.** Standard Intravenous Fat Emulsion Label Template: Adult.
*Specify product name.

Cont.

- At least 3 verification processes should occur in the pharmacy (Compounding 4)
  - After initial order entry of PN
  - Before manually injecting additives into the PN
  - Once the PN has been compounded
- Healthcare Organizations shall comply with USP Chapter <797> standards. (Compounding 4)
  - www.ismp.org/sc?id=469
  - “Rule number one...obey all rules..” B.Fife
- Schools of Pharmacy in the United States shall develop curricula that address proper aseptic technique and USP Chapter <797> for making compounded sterile preparations (CSP’s). (Compounding 1-2)
- Technicians shall be certified if involved in compounding TPN (Compounding 1-2)
- Healthcare systems shall require annual competency evaluations of pharmacists and pharmacy technicians. (Compounding 1-2)
Monitoring (2014 Safety Recommendations)

- Prescribing 4 (1.)
  - An institution-specific or organization-specific policy should be created to dictate the duration of a PN order.
  - Re-ordering process should be structured to require accountability for reviewing the orders, lab findings, and patient’s condition.

- Prescribing 4 (4a.)
  - Newly prescribed TPN patients should be monitored daily until stable (more frequently if necessary for significant metabolic abnormalities).

- Prescribing 4 (4c.)
  - Stable patients in the hospital with no required changes in formulation for 1 week should be monitored every 2 to 7 days.

- Prescribing 4 (4d.)
  - Stable patients in a hospital, long-term care, or home setting with no changes in formulation for more than 1 week should be monitored every 1-4 weeks or longer in select clinically stable patients.
Quick Tips...

• How to adjust electrolytes
  • According to lab trends (takes some practice)
    • Na can be difficult (may require volume adjustment)
  • Convert Cl\(-\) to Actetate\(-\) based on Acid-Base balance
    • As CO\(_2\) declines (below 20) on venous lab draw; pt. likely acidotic; therefore, convert Na and K from Cl to Actetate
    • If ABG available, verify with pH, etc.

• When to adjust macronutrients (i.e. are we feeding enough?)
  • Metabolic cart study (if available)
  • Nitrogen balance study
  • Pre-albumin trends (at least weekly)
  • Pt weight (post nutrition assessment)

• How to wean/discontinue
  • Wean as other nutrition being advanced (TF or PO)
  • Cut PN rate 50% at least 2 hours; then D/C
  • Be aware of PN component shortages and consult the ASHP and A.S.P.E.N. websites for current outages/shortages and recommended substitutions/alternatives.
Now.....What are we thinking?

- Why PN? (i.e. indication)
- What type of access does the patient have (PPN vs TPN)?
- Expected PN duration?
- Do we have a nutritional assessment?
- What are our goals, and how do we translate them into a PN order/product?
- What's the best method for delivery (Compounding/ premixed)?
- What/how do we monitor and adjust?
You're overthinking this, Phil.
Questions?

What do you call a deer with no eyes and no legs?

Still, No EYE Dear
References


