



Establishing a Gold Standard: The Clinical Advantages of Custom (Individualized) Parenteral Nutrition

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Learning Objectives

- Differentiate between customized (individualized), standardized and commercial PN
- Identify three patient safety practices when using customized PN
- Differentiate between patients who may be appropriate for commercial PN vs. patients who require standardized or customized PN
- List three monitoring points required to reassess patients' individualized needs



Evolution of Parenteral Nutrition¹

- 1628 – William Harvey
- 1831 – 1st hydration infusion
- 1896 – 1st glucose infusion in humans
- 1937 – Successful IV infusion of amino acids
- 1945 – Infusion into the superior vena cava
- 1961 – Development of 1st “tolerable” fat emulsion
- 1968 – Hyperalimentation (Known today as total parenteral nutrition)

1 History of Parenteral Nutrition, E. Vinnars and D. Wilmore JPEN 2003 27: 225



Definitions

Customized/Individualized PN

PN formulation based on patients' individual characteristics including weight, height, age, sex, clinical status, labs, output, current dietary information and plan of care. ²



Definitions

Standardized PN

PN formulation intended to meet the daily maintenance requirements of a specific patient population (e.g., age-, stress-, or disease-state-specific) and differentiated by route of administration (central vs. peripheral).²



Definitions

Commercial PN

Standardized PN formulation available from a manufacturer and requiring fewer compounding steps before administration²



Commercial Parenteral Nutrition

- Available in the US
 - Concentrated amino acids (+/- electrolytes) plus concentrated dextrose in multichamber bags or premixed solutions.
 - Procalamine is amino acids and glycerin that are heat treated. Dextrose can not be heat treated with amino acids due to instability caused by the Maillard reaction.
- Not currently available in the US with lipids, although these are made and used in other countries. Lipids must be added separately by facility or administered via y-connector
- Not available for neonates



Commercial Parenteral Nutrition

- Benefits
 - Lower cost although studies haven't clearly demonstrated that.
 - Lower risk of compounding errors, but again this is unsubstantiated.



Commercial Parenteral Nutrition

- Appropriate Applications
 - Smaller facilities with few patients that receive TPN
 - Facilities that do not have clinicians with expertise in nutrition support
- Appropriate Patients
 - Nourished patients expected to be NPO for >7 days who require nutrition to hold them over.
 - Pt who require TPN when orders are too late for start.
 - Home TPN patients who can not immediately receive their customized PN

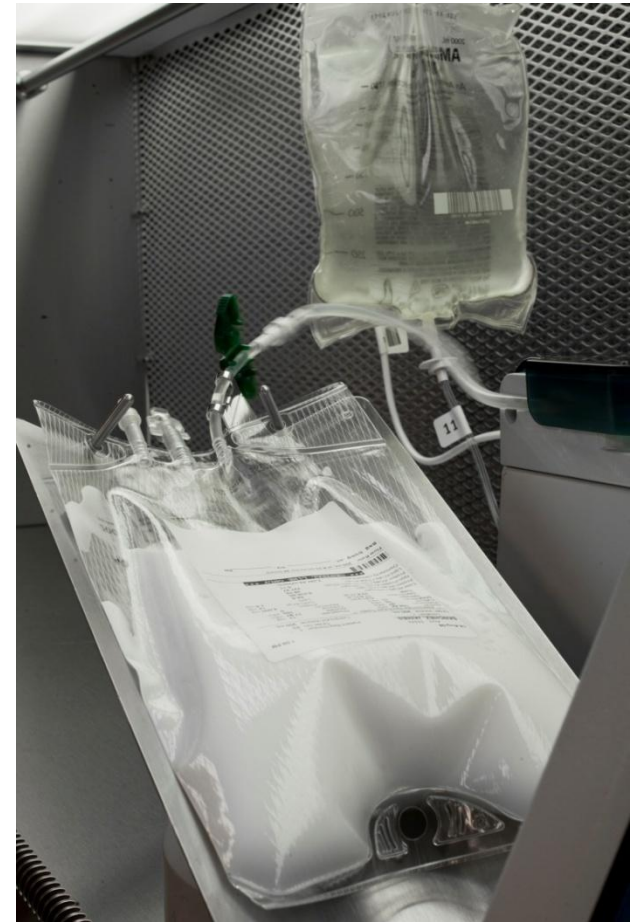


Swiss Study

- Facilities studied
 - 4 university hospitals
 - 13 cantonal hospitals
 - 6 regional hospitals
 - 1 private clinic
 - 2 home-PN providers
- 3 years
- Looked at the use of commercial versus custom PN

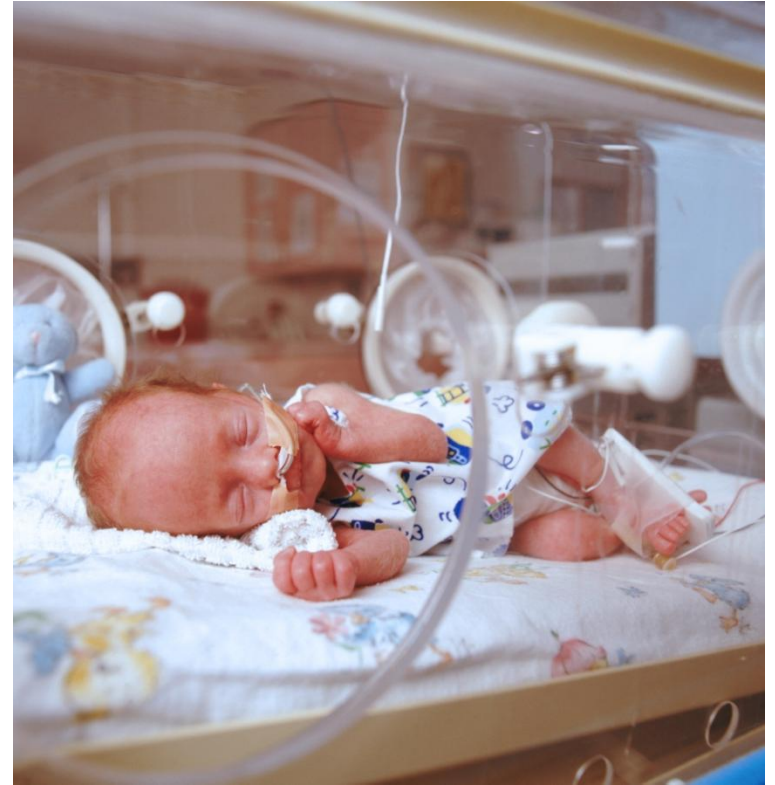
Swiss Study

- Only three hospitals used customized PN for adult patients
- 98-100% of hospitals supplemented PN with trace elements/vitamins/electrolytes in the pharmacy
- Commercial PN formulations generally provided more energy as lipid



Swiss Study

- Hospitals carried anywhere from 1-8 variations of commercial PN
- No cost difference was found between custom and commercial PN
- All but two hospitals provided pediatric patients with customized PN



Swiss Study

- Home PN was provided as commercial PN to short-term consumers by the home nutrition support companies
- Long-term home PN was provided as custom PN by hospitals



Why customize?

- Caloric prescriptions have been fine tuned over the years.
 - In some institutions O2 measurements allow for exact measurement of energy expenditure.
 - Age, genetics, nutritional status, disease process, comorbidities, and plan of care all contribute to energy expenditure
- Additives used in PN also differ based on the above contributors
 - L-cysteine
 - Glutamine
 - Carnitine



Risks of overfeeding

- Refeeding syndrome
- Increased CO₂ production/respiratory distress
- Pulmonary edema
- Fatty liver

Risks of underfeeding

- Poor wound healing
- Poor immune function
- Muscle loss/catabolism
- Metabolic bone disease

Appropriate Patient Populations for Customized PN

- Renal, hepatic or other organs are compromised
- Patients with glucose intolerance
- Patients at risk for refeeding syndrome
- Adults with critical illness
- Adults with abnormal body composition
- Adults with large GI fluid losses
- Home parenteral nutrition patients
- Neonates and pediatric populations



Appropriate Patient Populations for Customized PN

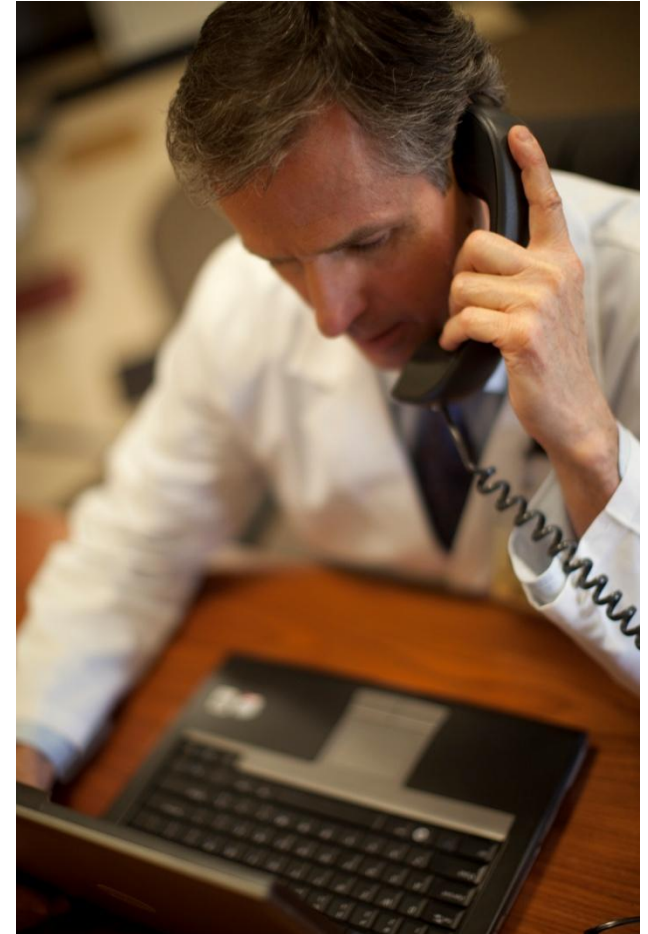
- Patients with very short bowel
- Hyperemesis gravidarum patients
- Hypermetabolic cancer patients with mucositis/GI compromise
- Patients status post gastrointestinal transplant who have been unable to progress to enteral or PO regimen



Patient Safety with Customized PN

Standardized ordering

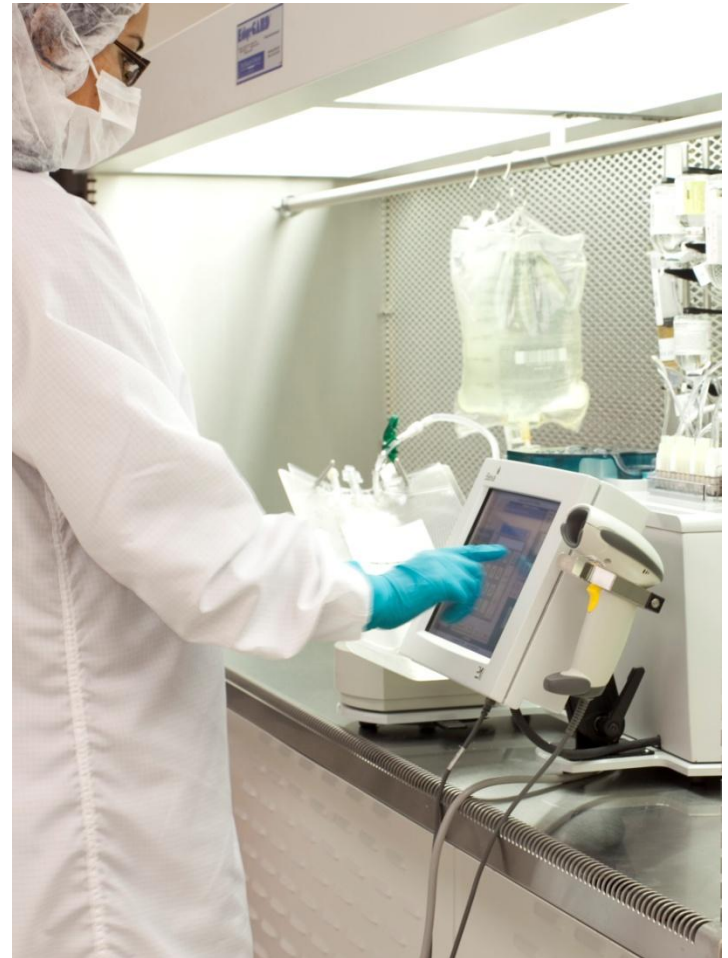
- Develop standardized order forms
- Second clinician to assess whether formula is appropriate
- Use total daily dose in ordering



Patient Safety with Customized PN

Standardized compounding

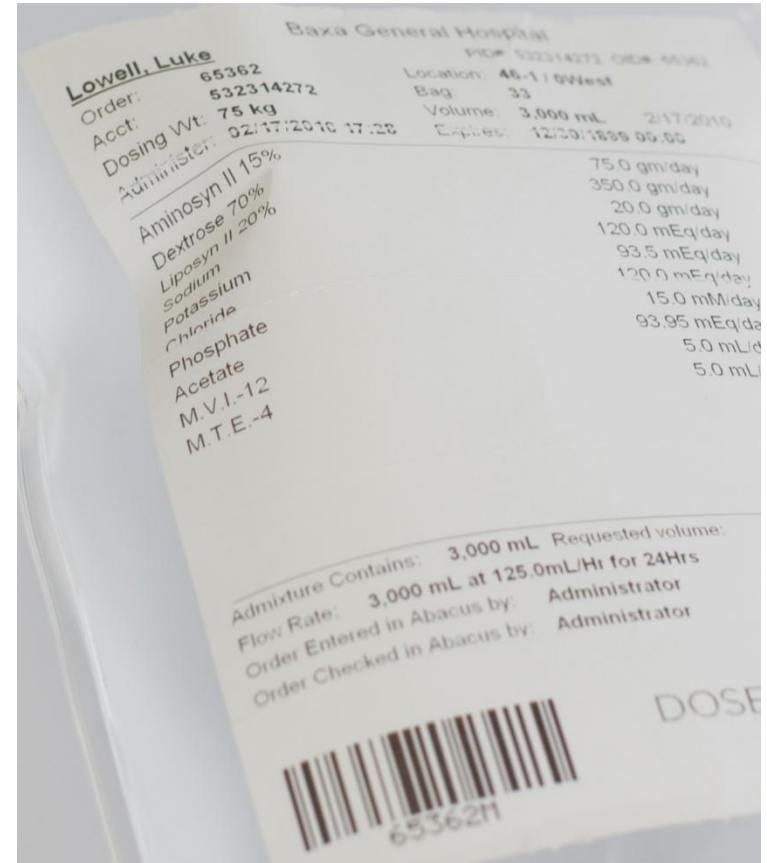
- Sterile
- Stable
- Compatible



Patient Safety with Customized PN

Standardized labeling

- Total amount per day listed clearly for all components
- Amount per liter may also be listed in parentheses if pharmacy mixes in 1 L volumes



Patient Safety with Customized PN

Standardized administration

- Verify patient name
- Review label for accuracy and expiration dates



Key to Successful Customized PN? Monitoring

- Anthros
 - Adults – Promote appropriate weight gain or weight stability
 - Peds – Promote weight gain and growth appropriate for age
- Labs



Monitoring

- Diet
 - Goal is always to progress patient to diet as close to PO as possible
 - TPN is modified to promote this goal
- Clinical
 - Patients requiring TPN have a clinical condition with a plan of care
 - As condition changes, it is likely that TPN needs will change as well



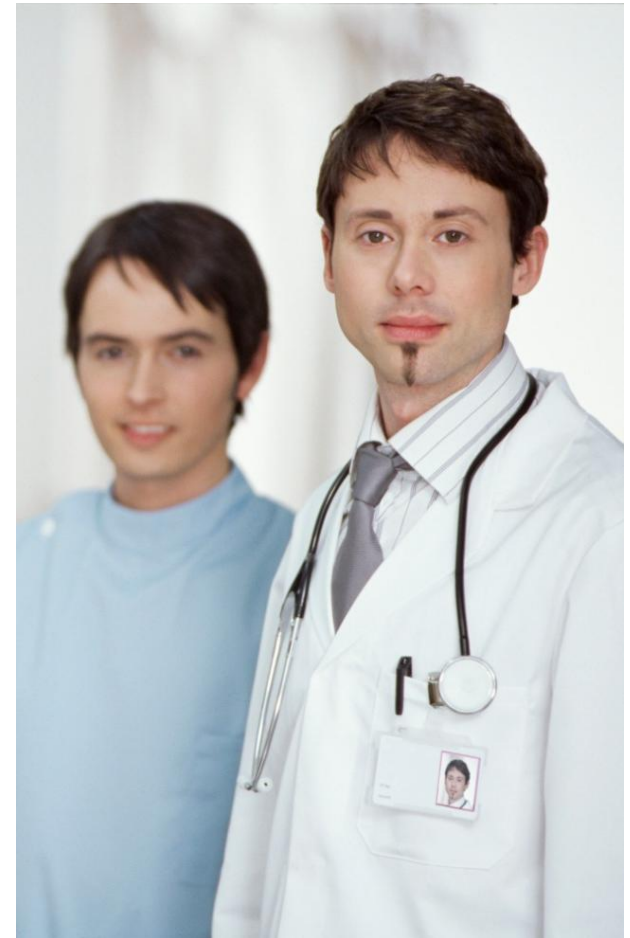
Nutrition Support Teams

- Clinicians with expertise in nutrition support maintain safe practices in parenteral nutrition
- Nutrition Support Team
 - Registered Dietitian
 - Nursing
 - Doctors
 - Pharmacists



Education and Training

- Do dietitians, nurses, pharmacists and physicians enter into practice with grounded knowledge of nutrition support needs for patients?
- Or do most of us involved with nutrition support learn “on-the-job” and through additional educational opportunities?



Summary

- Safe parenteral nutrition minimizes the possibility of procedural risk while maximizing the ability of parenteral nutrition to meet individual patient needs.
- Consider your facilities' patient populations and clinical capabilities
- Further research and innovation in parenteral nutrition support are needed



Questions



References

- 1 Vinnars, E. and Wilmore, D. “History of Parenteral Nutrition.” *JPEN* 2003 27: 225
- 2 Kochevar, M. Guetner, P. Holcombe, B., Malone, A., and Mirtallo, J. “A.S.P.E.N. Statement on Parenteral Nutrition Standardization.” *JPEN* 2007 31: 5
- 3 Miller, S. “Commercial Premixed Parenteral Nutrition: Is It Right for Your Institution?” *Nutrition in Clinical Practice* 2009 24: 459
- 4 Pichard, C., Muhlebach, S., Maisonneuve, N., Sierro, C. “Prospective Survey of Parenteral Nutrition in Switzerland: A Three-Year Nation-Wide Survey.” *Clinical Nutrition* 2001 20: 4

