



Safety Practices for TPN Compounding

BECAUSE THE RISKS ASSOCIATED WITH TPN COMPOUNDING ARE SO significant, establishing and implementing policies and procedures to mitigate those risks is of vital importance.

Evaluating Your TPN Practices

Ensuring the safety of the TPN solutions administered to your patients is not a process that begins and ends with a review of your compounding procedures. Rather, an evaluation of all of your TPN practices must be conducted. Particular attention should be paid to:

- ▶ Who assesses the need to start a patient on TPN?
- ▶ Who evaluates and determines the nutritional requirements of the patient?
- ▶ Are TPN orders customized, or are standard TPN solutions used?
- ▶ How are the nutritional requirements converted to a TPN order?
- ▶ Does the order form match the processes for compounding the prescriptions?
- ▶ Does the TPN preparation method meet the patient's needs?
- ▶ How do QA processes aid the TPN process?

After using one of the many methods to determine whether a patient is a good candidate for TPN infusion, your primary goal is to establish a process that determines the most cost-effective method for properly feeding a patient.



Using bar coding technology with automated compounding devices can increase safety.

The concentration of TPN needed to properly feed the patient will determine which venous access point must be used. While each institution determines the osmolarity values used to differentiate central and peripheral solutions, generally a final concentration of about of 5% dextrose will require a central access point. Osmolarity cutoffs for peripheral versus central TPNs range from 900 to 1000 mOsm per liter.

Once the access point is established, an evaluation of the patient's nutritional needs must be completed. The physician, dietician, pharmacist, nutritional committee, and various combinations thereof will determine the patient's nutritional needs. Each institution is unique in terms of who is involved in the nutritional decision-making process. In some cases, the physician determines the patient's nutritional require-

ments, and in others, the physician orders nutritional support and the patient's nutritional requirements are determined by a dietician. When resources allow, the best group for determining nutritional requirements and therapy is composed of the physician, dietician, and pharmacist. Each member of the group provides expertise in their respective area to provide the best care for the patient. TPN choices range from straightforward, ready-to-use (RTU) products to customized, pharmacy-compounded TPN solutions, which are completely tailored to the individual patient's needs.

Ready-to-Use Solutions vs. Customized TPN

Consideration should be given to RTU solutions particularly for initial dosages and for institutions where automated equipment is not warranted. It is important to note, when adding items like electrolytes, vitamins, or trace elements to the RTU solution, the extra volume needs to be included when determining the rate to assure the patient receives the prescribed amount. Because RTU products limit the ratio of nutritional components that can be given to the patient, customization with these products is more difficult. Furthermore, current software does not account for the extra ingredient volumes added to the TPN.

Tailoring TPN to a patient's needs allows for customization of the amount of amino acids, dextrose, and lipids, along with the bag volume. This method provides the fullest range of options to meet the patients' nutritional needs. Customization is the best course of action for neonates and patients that are unstable or have fluid restrictions. Customization is also a good choice when the institution is doing more than 15 patients per day or has more than 50 syringe additions to TPN bags. RTU products are better used with stable patients and when the institution has a very limited number of TPN patients.

General cost considerations between RTU and custom products depend upon the number of TPNs being made and the stability of the patient. Custom solutions have inherent costs such as the compounder sets, but allow caregivers to meet an individual patient's needs. RTU products require the institution to carry a wide range of concentrations, necessitating additional inventory management. The decision to use custom versus RTU products, or a combination thereof, must be based on the institution's specific needs.

Avoiding Risks in the Ordering Process

Ordering TPNs can be a complex process given the different methods used to determine dosages. Generally, the patient is assessed in terms of their needs for:

- ▶ amino acids
- ▶ dextrose
- ▶ lipids

Amino acids can be specified in grams of amino acids, grams of nitrogen from the amino acids, the final percentage, or a volume of a specific amino acid concentration. Dextrose can be specified in kCal, the final percentage, or a volume of a specific dextrose concentration. Lipids, which can either be in the TPN or administered separately, can be ordered in kCal, the final percentage, or a volume of a specific lipid concentration.

Whichever method is used to determine dosages, conversions should be avoided when transcribing to the order form. Generally it is recommended to use grams of amino acids, kCal of dextrose, and kCal of lipids. Ordering amino acids and dextrose in the final concentration can cause a major challenge when attempting to con-



Photo courtesy of B. Braun

vert the order to include the lipids with the TPN. This can become even more complicated if the electrolytes are ordered per volume and did not compensate for the lipid volume added to the bag.

Order Forms

In order to avoid conversion errors, the order form should reflect the institution's approved method used for determining the dosages of the TPN components. Therefore, if your facility decides to use grams per patient weight of amino acids, the order form should allow the prescriber to only order in this manner. Utilizing a form that mirrors the ordering method will prevent conversion errors, which tend to occur when the dosage form is converted from one form to another. For example, conversion errors commonly occur when grams of amino acids are determined and then converted into a final percentage. The best way to prevent conversion errors is to not to make conversions at all. This provides the additional benefit of allowing clinicians to match the original order to the TPN label.

Software

Using software to perform the calculations from the original order to the volumes of each component in the solution adds another layer of safety to the TPN process. Software allows the institution to perform TPN calculations in exactly the same way each and every day and prevents calculation errors from being introduced into the TPN. Software will also check for anion/cation limits and calcium/phosphate issues, and notify the compounding pharmacist of over- and under-dosing. It is imperative that every calculation be documented – whether software is used or not – to ensure that each person performs the calculations in the same manner for each and every order.

Automated Compounding Devices

Further safety checks are available when using automated compounding equipment to electronically send the ingredient volumes to a compounder. These devices can prevent the transcription errors that can occur during the manual entry of the volumes of each ingredient into the compounder. Using automated equipment provides assurance that your TPN is made the same way every day. It is also recommended to use the software option with automated compounding equipment, as it helps to confirm that the proper ingredients are hung on each line before the order is electronically transferred to the compounder.

However, even when using automation, errors can still occur. Therefore, care must be taken to avoid common missteps. Most of the potentially fatal errors that occur are a result of improper handling of source solutions. The biggest culprit is the switching of dextrose for sterile water. Proper QA processes should be adhered to when hanging solutions on the automated compounding equipment, regardless of whether software transfers the ingredient information or the information is manually programmed.

To further increase safety, automated compounding equipment can use bar coding technology to confirm what is in the ingredient lines to help prevent improper hanging of solutions. Using automated compounding equipment provides the added benefit of automatically creating a record of compounded TPN to meet QA requirements.

Key Approaches to Error Prevention

Because of the risk associated with improperly handled source solutions, it is recommended that you limit the source solutions available. This means stocking one amino acid for adults, another for neonates, and any other necessary specialty products. Stocking just one strength of dextrose and lipids also helps prevent the wrong solution being used during compounding. By limiting the number of solutions, you decrease the line items the facility must carry, thereby simplifying your inventory management. Keep in mind, if you choose to also stock RTU solutions, the inventory savings will be offset, as you will be required to stock multiple solutions to fill patient needs.

One of the most important methods you can use to prevent errors is to not use the TPN bag as a hydration or electrolyte source. Changing the rate to either alter the amount of electrolytes or to increase or decrease the amount of fluid being given results in the patient being overfed or starved. The TPN is not an electrolyte or hydration source and should not be used as such; it is solely a source of nutrition for the patient.

Institutions should establish specific policies and procedures for TPN usage and prescribing, and provide nutritional training to their staff. It is also recommended that the institution appoint an active nutritional committee to evaluate each patient on a daily basis in order to ensure that the best care is provided.

Conclusion

The entire TPN process must be evaluated with the goal of providing the best product to the patient. Vigilance over the process, from ordering methods to forms and from ingredients to compounding equipment, must be continually maintained. ■

Currently the director of information technology operations for SoluNet LLC, David L. Thomas, RPh, MBA, previously served as the manager of implementation and technology development for Baxter Healthcare and as the technology systems manager for Baxter's COMPASS IV admixture service. Before his 15-year tenure with Baxter, Thomas held hospital pharmacy practice and management positions for five years.

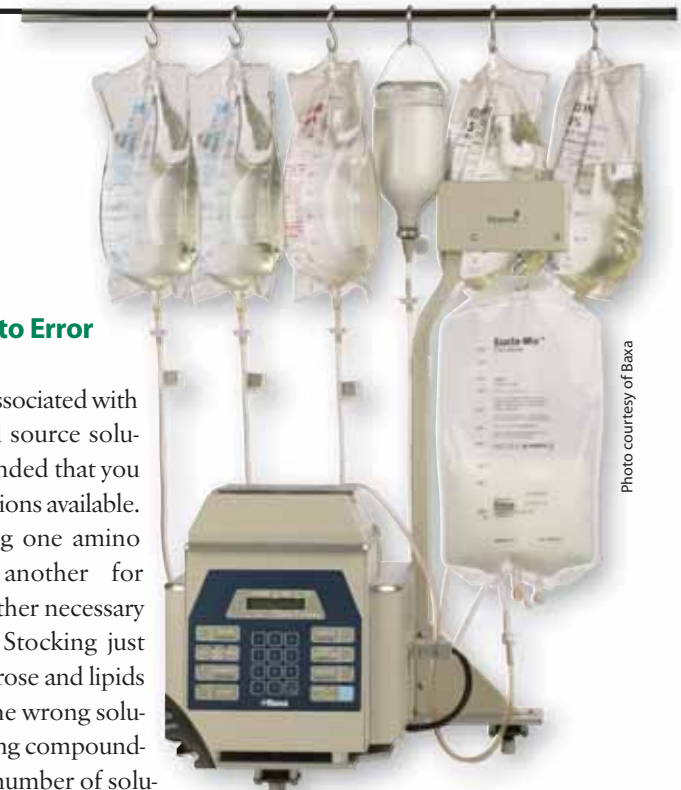


Photo courtesy of Baxa

WHERE TO FIND IT:

Vendor	TPN Components	Automated Compounding Devices	Reader Service Number	Website
American Pharmaceutical Partners	X		94	www.appdrugs.com
American Regent	X		7	www.americanregent.com
B. Braun Medical Inc.	X	X	93	www.bbraunusa.com
Baxa Corporation		X	8	www.baxa.com
Baxter Healthcare	X	X	92	www.baxter.com
Hospira	X	X	9	www.hospira.com
Secure/The Metrix Company		X	91	www.metrixco.com