



Filtering Parenteral Nutrition at Home: A Recommended Practice Change

By Patricia Worthington, RN, MSN, CNSC and Peggi Guenter, PhD, RN, FAAN, FASPEN

Parenteral nutrition (PN) has been a traditional home infusion therapy that keeps thousands of patients in the home setting alive and out of the hospital. One of the important safety measures employed with PN is the use of in-line filters to prevent particulate matter from entering the circulatory system. Historically it has been recommended to use a 0.22-micron filter for the dextrose-amino acids admixture and a 1.2-micron filter for lipid injectable emulsions (ILE) or for total nutrient admixtures (3-in-1 admixture).¹ Guidelines for using filters for PN have been issued by a number of professional organizations and manufacturers of PN components. Yet despite this guidance, filter use remains controversial. Recent changes in recommendations for filtering ILEs have added to confusion and created considerable variation in practice.

The American Society for Parenteral and Enteral Nutrition (ASPEN) has created a position paper to review past guidance regarding the filtration of PN, examine the clinical consequences of infusing particulate matter, discuss the challenges and issues related to filtration, and clarify the ASPEN recommendations for the use of filters for PN administration.² The paper, *Update on the Use of Filters for Parenteral Nutrition: An ASPEN Position Paper*, can be accessed at <https://doi.org/10.1002/ncp.10587>
See Exhibit 1 for a summary.

Identifying a Need

According to a 2017 survey by Christensen,³ between 80-90% of PN is filtered, depending on the type of PN. Another way to look at it is that 10-20% of respondents did not filter either the 3-1 PN or the ILE. According to this survey, respondents reported that they do not use IV in-line filters due to lack of evidence and lack of understanding. This includes the beliefs that IV in-line filters are only used in neonates, that they get clogged with lipids, filters are very costly (purchasing committee denied purchase), and that IV in-line filters are only useful for filtering particulate matter and not microbes. The Christensen paper revealed far more confusion and variation regarding in-line filter use than expected.³

Recommended Practice Change

An ASPEN task force reviewed the literature on filtering and to determine the reasons for using 2 IV in-line filters, and then make a practice change recommendation. Many articles held the view that the primary purpose of in-line filters is to protect against infectious complications, while the danger presented by particulate matter was not widely appreciated and basically overlooked. As the work progressed, some recommendations became obvious, such as the critical importance of filtering PN at all times. The most important recommendation made in the 2021 position paper is the change from using 2 in-line filters to 1 in-line filter closest to the patient.² Using 2 different sized filters led to confusion and increased the potential for errors among nurses and lay caregivers who administer parenteral nutrition at home. The task force felt that using a single 1.2-micron in-line filter would streamline parenteral nutrition administration procedures and improve compliance with IV in-line filter use. The next step was to get the word out to clinicians about filtering appropriately.

EXHIBIT 1

Update on the Use of Filters for Parenteral Nutrition Fact Sheet

Executive Summary

- In-line intravenous filters serve a critical purpose in reducing exposure to particulate matter during parenteral nutrition (PN) therapy.
- Particles greater than 2 microns, which are retained by 1.2-micron filters, appear to pose the most serious risk for adverse consequences.
- Based on best available evidence and guidance from scientific and regulatory agencies, the American Society for Parenteral and Enteral Nutrition (ASPEN) recommends using a 1.2-micron in-line filter for administration of total nutrient admixtures (TNAs), dextrose-amino acids admixtures, and lipid injectable emulsions (ILE).

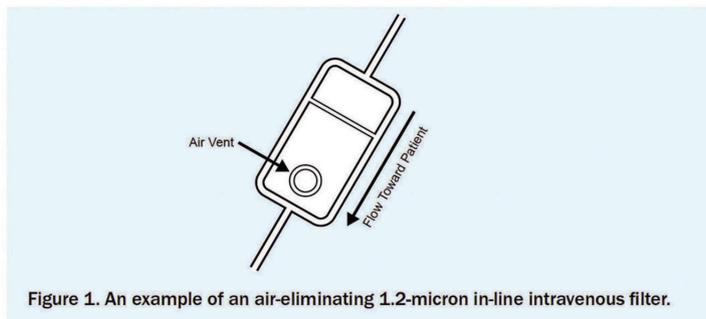


Figure 1. An example of an air-eliminating 1.2-micron in-line intravenous filter.

- For TNAs, place the 1.2-micron filter as close to the catheter hub as possible. For dextrose-amino acid admixtures, place the filter below the Y-site where the dextrose-amino acids admixture and the ILE co-infuse.
- The safety of using a single 1.2-micron filter for PN administration is supported by decades of experience in hospital and homecare settings. This approach alleviates the confusion and errors associated with using 2 filters with different pore sizes. Simplifying filtering practices could potentially increase compliance with recommendations for filter use with PN administration.



Rationale Behind the Recommendation

Studies of particles found in parenteral nutrition formulations have shown that the size can vary from 1.3 microns to greater than 10 microns. The primary risk stems from particles greater than 5 microns in size. The risk posed by these particles is related to the diameter of the pulmonary capillaries, which generally range between 5-8 microns. Particles larger than the capillary will become trapped in the lungs, leading to pulmonary complications. Particles smaller than the capillary diameter pass through the lungs and will be deposited into organs such as the liver or spleen, to be eliminated through the action of the reticuloendothelial system.

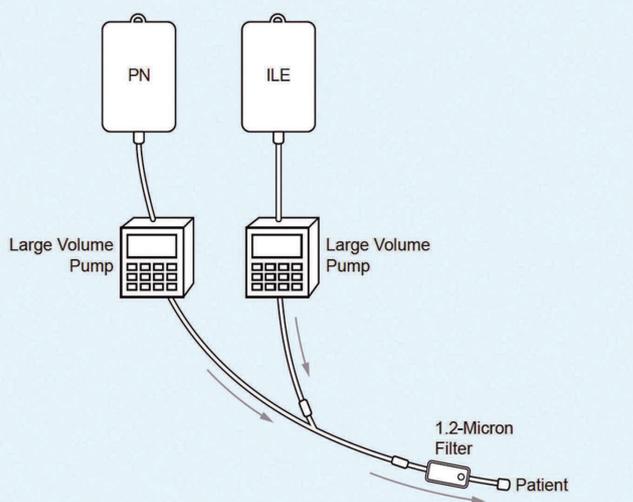


Figure 2. Setup for using a 1.2-micron in-line filter to administer dextrose-amino acids admixture with ILE given as a separate infusion.

PN = Parenteral Nutrition ILE = Lipid Injectable Emulsion.

- Although 1.2-micron filters are not recommended for use as a routine infection control measure, these devices are effective in preventing *Candida albicans* a pathogen frequently associated with PN administration, from reaching the patient.
- ASPEN recommends that health care organizations that do not filter PN admixtures or ILE reevaluate these decisions and consider the small cost of filters in comparison to increased morbidity and mortality that may result from not filtering ILE or PN.



While particles 5 microns or larger pose the greatest risk for pulmonary complications, evidence also suggested that higher levels of organ dysfunction occurred in critically ill adults when 5-micron in-line filters were compared to in-line filters with finer pore sizes.⁴ However, at the present time, there is insufficient evidence regarding the impact of particles smaller than 2 microns. It is important to note the clinicians who first identified and reported adverse events related to the administration of unfiltered parenteral nutrition, particularly Dr. Puntis in his 1992 paper on the subject.⁵ In addition, the review on particulate matter by Dr. Stephen Langille provided an

excellent foundation for this ASPEN position paper.⁶ Numerous studies done by a group of researchers from the University of Lille, gave insight into the problem of particles present in IV fluids and highlighted the important role of in-line filters in IV therapy.⁷⁻¹⁰

While the position paper mostly focuses on the risk of infusing particles during IV therapy, other hazards such as air, bacteria, microorganisms, or endotoxins were also considered.² The paper notes that IV in-line filters also protect against those risks, stating that they “block microbes, air, and enlarged lipid droplets from reaching the circulation.” However, the ability of in-line filters to capture particles was prioritized because this carries the most prominent, and often overlooked, risk to patients. Clinicians often feel that particle contamination is an unusual event, due to compounding errors or by prescribing calcium or phosphate in inappropriate amounts. In other words, there is insufficient appreciation that particulate matter is always present. By emphasizing the risk posed by particulate matter, the position paper also clarifies that in-line filters serve a limited role in reducing infectious complications of parenteral nutrition, because in most cases, contamination

occurs after the fluid has passed through the in-line filter. The U.S. Centers for Disease Control and Prevention (CDC) advise against using IV in-line filters for infection control purposes, which has led some clinicians to incorrectly believe that in-line filters are not needed if infection rates are low, and this paper aimed to correct that misconception.¹¹

Clogging of Filters

It is not uncommon for filters to block or clog during administration, but that simply means that they're doing their job. Because of the concern that patients or caregivers may be tempted to

simply remove a clogged filter, the position paper emphasizes that PN admixtures should never be allowed to infuse without an in-line filter. Exhibit 2 presents a series of troubleshooting steps to follow if an in-line filter does clog. These steps include ruling out occlusions that are not related to the in-line filter, verifying that the correct size in-line filter has been used, and consulting a home care pharmacist to review the prescription.

EXHIBIT 2

Appropriate Response to High Pressure Alarms or a Potentially Occluded Filter

1. Verify that appropriate pressure setting has been used on the infusion pump.
2. Rule out mechanical or thrombotic causes of high-pressure infusion pump alarms:
 - a. Trace the administration tubing from the pump to the VAD, checking for kinks.
 - b. Confirm that all administration tubing clamps are open.
 - c. Assess the patency of the VAD according to organizational policies.
 - d. Inspect the dressing on the VAD to ensure that the catheter is not kinked or twisted under the dressing material.
3. Verify that correct size (1.2-micron) filter has been used.
4. If correct size filter is in place, assume that particulate matter is the cause.
Remember that precipitates can occur hours after compounding.
 - a. Remove the occluded filter and replace it with a new filter of the same pore size.
 - b. Be alert for repeated episodes of occlusion.
 - c. Never allow an unfiltered PN admixture to continue to infuse.
5. Conduct a pharmaceutical review of the PN formulation to determine the underlying cause of the occlusion and identify actions to prevent further occurrences.



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Best Practices

See Exhibit 3 for a summary of best practices. Home infusion providers should review their PN protocols and include these best practices along with re-educating PN patients and caregivers on the use of one filter for PN administration. This will avoid confusion and should decrease equipment costs as compared to previous recommendations.

EXHIBIT 3

Summary of Best Practices for Using In-Line IV Filters with Parenteral Nutrition

1. Prior to compounding, a pharmacist must verify the stability and compatibility of the PN formulation.
2. Perform visual inspection of the PN container for evidence of particulate matter or admixture instability, including emulsion cracking for TNAs.
3. When administering the dextrose-amino acid component of the PN and the ILE as separate infusions, the first infusion must be completely set up and the pump programmed for that fluid before setting up the second infusion.
4. Avoid co-administration of medications with PN admixtures. When no other option exists, use appropriate flushing techniques before and after the medication is administered.
5. When co-administration of medications with PN cannot be avoided, the medication tubing should be attached at a Y-site above the filter. Medications that should not be filtered must not be administered with PN.
6. Select a 1.2-micron filter for all PN regimens including TNAs, dextrose-amino acid admixtures, and ILE.
7. Observe the manufacturer's directions for priming the filter before connecting to the patient's vascular access device.
8. Follow the manufacturer's instructions included with the filter or administration set with in-line filter for priming. Many filters require holding the filter vertically while priming.
9. To avoid clogging the filter during set up, consider allowing a small volume of ILE through the administration tubing allowing the ILE to enter the filter. Close the clamp on the ILE administration set. (Optional)
10. Prime the dextrose-amino acid admixture through the administration tubing completely filling the tubing and filter to the distal end of the tubing. This will dilute the ILE present in the filter to avoid clogging.
11. Connect the filter to the hub of the patient's vascular access device (VAD). When administering the dextrose-amino acid component of the PN and the ILE as separate infusions, attach the filter below the Y-site where the infusions meet.
12. Release all clamps and initiate the infusion.
13. Schedule filter changes to coincide with the initiation of a new PN admixture and administration set.



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