Small- and Large-Volume Fluid Shortages
Suggestions for Management and Conservation

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Please email PracticeAdvancement@ashp.org with comments or questions.

Introduction

This fact sheet provides potential actions for organizations to consider in managing fluid shortages. Healthcare practitioners should use their professional judgment in deciding how to use the information in this document, considering the needs and resources of their individual organizations.

Why is Conservation Necessary?

There is a national shortage of large-volume parenteral solutions, including but not limited to: sodium chloride injections, Lactated Ringers injection, Sterile Water for Injection, and Dextrose injections. The shortages are due to the effects of Hurricane Helene in North Carolina.

Definitions

Small-volume parenteral solutions (SVPs) — a solution volume of 100 mL (as defined by USP) or less that is intended for intermittent intravenous administration (usually defined as an infusion time not lasting longer than 6-8 hours).[1]

Large-volume parenteral solutions (LVPs) – a solution volume of greater than 100 mL (as defined by USP)

Intravenous (IV) push — The Institute for Safe Medication Practices (ISMP) defines IV push as "direct, manual administration of a medication using a syringe, usually under pressure, connected to an IV access device."[2] Best practice recommends that whenever possible the actual rate of IV push administration specific to a given drug be noted and that terms such as IV push (unspecified), IV bolus (unspecified), slow or fast/rapid IV push should be avoided.

Ready-to-administer — A dosage form or concentration that can be administered to the patient without further manipulation

General Recommendations

- Implement an organization-specific action plan to conserve IV fluids where possible. Organizations must be flexible as the status of specific products may vary. Establish policies to allow for interchanges between clinically equivalent products when possible.
- Ensure an interdisciplinary team is making rationing decisions using an ethical framework.[3]
- Communicate changes in shortage status and action plan adjustments to stakeholders as soon as possible.
- Identify vulnerable and populations with specific needs, such as pediatric and neonatal patients, and consider specific policies and practices that reserve or prioritize fluid products for their needs.

Conservation - Large Volume Products

- Evaluate the clinical need to continue intravenous fluid replacement at every shift change and bag change.
- Assess the need to initiate "keep vein open" (KVO) orders and the need to continue those orders at every shift change.
- Review the organization's standard KVO rates and consider reducing to the lowest reasonable rate.[4]
- Consider catheter locks with flushes for eligible patients.
- Use oral electrolyte and hydration whenever possible.[5]
- Discontinue infusions as soon as appropriate.
- Avoid discontinuing and restarting intravenous fluids during transitions of care (such as between the emergency department and other nursing units) unless clinically necessary.
- Consider policies that allow completion of a currently hanging infusion bag before switching to a different infusion product unless clinically contraindicated.
    - For example, if an order is changed from 0.9 % sodium chloride to dextrose 5 % with 0.45 % sodium chloride, consider allowing completion of the bag of 0.9 % sodium chloride before switching to prevent waste and prolong the total infusion time of available fluids.
- Evaluate total fluid requirements for surgeries and transition to oral fluids within 24 hours after surgery.[6]
- Develop policies for substitution of intravenous solutions based on product availability in the organization. Example: an organization might allow substitution of Lactated Ringers for 0.9% sodium chloride or vice-versa depending on what is in stock. Table 1 provides a comparison of common intravenous fluid components.
- Use smaller volume bags for low infusion rates (see Table 2).
- Consider reserving some products for specific clinical situations as outlined in Table 3.
- Avoid opening and "pre-spiking" bags in anticipation of use for surgery.
- Use other large volume electrolyte replacement solutions where appropriate.
- Consider hang times of <u>up to</u> 96 hours for solutions (if spiked immediately prior to administration). In making such a decision, hospital leadership; medical, nursing and pharmacy staff; infection control; risk management and other stakeholders should weigh the risk of infection against the need to conserve intravenous solutions.[7]

Conservation - Small Volume Products

- Review the use of fluids as supplies. Many areas use SVP fluids to start intravenous lines, administer blood, or flush lines. During these shortages, consider using single-use flush syringes when possible, although these products can also be affected by shortages.
    - Switch products to IV push when the patient's clinical status drug properties (e.g., pH, osmolarity) allow. Follow ISMP Safe Practice Guidelines for Adult IV Push Medications.[2]
    - Adhere to the CDC use guidelines for single-use vials.[8]
- Change IV medications and electrolytes to a clinically appropriate oral product whenever possible.
    - Work with the organization's P&T committee, or equivalent, to review current IV to oral (PO) policies.
    - Policies may need to be expanded to include other drug classes.
- If oral route is not feasible or indicated, some medications can be administered via intramuscular or subcutaneous injection.
    - Adhere to recommended maximum volumes for a single injection; doses may need to be divided into more than one syringe.
- Consider alternative intravenous solutions when therapeutic interchange is not clinically important (e.g., maintaining line patency, for blood administration, etc.).
- Review the stock of small volume bags and vials to determine stock on hand that is compatible with proprietary bag-and-vial systems.
    - Do not make practice change plans that will require additional fluids or specific products (e.g., requiring additional mix-on-demand supplies).

Operational Strategies – Large Volume Shortages

- Evaluate supplies on a health system-wide basis to redeploy solutions to areas of greatest need.
- Minimize unit stock of large volume bags to the extent possible or stock only in critical care, procedure, and emergency care areas where fluids are an essential component of supplies.
- Ensure smaller volume bags are stocked in supply areas.
    - If conservation of SVP bags is necessary, stock only in areas where medications must be prepared so that supplies can be consolidated.
- Work closely with the supply chain team to obtain accurate system-wide estimates of stock on hand, particularly in health-systems where pharmacy does not supply all fluids.
- Consider using smaller volume bags or vials of saline and sterile water for reconstituting drugs in the pharmacy instead of using liter bags.
- Medicare will not reimburse for oral hydration in the Outpatient Prospective Payment System (OPPS). This applies to patients in ambulatory care settings and patients in the ED who are not admitted to the hospital. Medicaid patients are reimbursed in accordance with state-based policy.
- Avoid buying products from sources outside the traditional supply chain. Report suspected illegal activity by nontraditional distributors to your state board, state attorney general, or FDA's Office of Criminal Investigation.

Operational Strategies – Small Volume shortages

- Transition to commercially manufactured premix medications when available.
- If switching to IV push, ensure sufficient supplies of diluent vials, syringes, and needles are available to accommodate these doses.
- Leverage admixtures available from 503B outsourcers when available.

    - Also communicate with 503B outsourcers to understand how their supply may be affected by shortages.
- Consider changes in the electronic health record (EHR) to allow the use of either dextrose or saline for admixture of drugs compatible with both solutions. This will help create better flexibility based upon which products are available at the time.
    - Use EHR alerts or forced functions when a drug is compatible in only one diluent.
    - Implement or encourage the use of barcode scanning of admixture ingredients to ensure the correct solution is used and documented.
- Consider preparing and dispensing medications that may be administered IV push in ready-to-administer concentrations packaged in syringes.
    - External references are available with information on concentrations and administration rates. See the ***External Resources*** section for additional information.
- If your organization can utilize syringe infusion pumps, consider preparing and dispensing non-IV push medications in ready-to-administer syringes to be infused via syringe pump.
- If empty bags are available, and all other options have been exhausted, consider compounding SVPs of 5% Dextrose or 0.9% Sodium Chloride. This may not be possible if the fluid shortage includes both SVPs and LVPs.
    - The preferred method for these preparations is to use 1 L bags of commercially available 5% Dextrose or 0.9% Sodium Chloride to repackage into smaller bag sizes (50, 100, or 250 mL).
    - Peristaltic pumps may be used for compounding and will help ensure accuracy and minimize employee fatigue and over-use injuries.
- If compounded or repackaged bags have been frozen to extend dating, thoroughly inspect the bag before dispensing to ensure the bag did not crack or split during frozen storage.
    - Follow USP Chapter <797> and state rules and regulations for determining applicable beyond-use dates.[9]
    - Only compound in an empty container that adequately reflects the final volume: for example, 100 mL of solution in a 100 mL empty container.
        - If necessary to compound in a bag with larger capacity than the final volume of solution, the pharmacy label should be affixed so that it covers the empty capacity printed on the bag. For example, if compounding 50 mL total volume in a 150 mL container the pharmacy label should cover the 150 mL print on the bag.
- Ensure that the temperature for refrigerators and freezers are continuously monitored.
    - Double check that they are plugged into emergency power outlets.

Infusion Pumps / Informatics Strategies

- Allocate appropriate clinical informatics resources to manage critical shortages.
- Ensure existing pump libraries are up to date to ensure safe and consistent practices.
- It may be necessary to change or add to drug libraries. If so, use clinical, safety/quality, and informatics teams to ensure that any additions or changes have been vetted through appropriate channels.
- Drug records, order-sets, and treatment protocols will need to be reviewed for changes based on available products.
    - These may include solutions used for medication dilution or solutions available for line patency.

- Reflect use of smaller volumes in infusion pump libraries, electronic order sets, and standard fluid labels as needed.
- Take the opportunity to review, revise, or develop good infusion pump practices and protocols.
- Consider where and when other types of ambulatory infusion pumps can be used.
- Try to maintain standardization whenever possible, especially if the same pumps are used for both adult and pediatric patients.

Communication Strategies

- Adequately communicate any changes to current practice using established communication channels within your hospital or health system, such as local intranet, EHR alerts, emails, daily huddles, flyers, labeling, etc.
- Be sure that the clinical informatics team is aware of the need to make priority changes in drug records, charge description masters, and infusion pump libraries and recognize that they will not have the normal lead time that this process generally requires.
- Consider having a physician and nursing champion in addition to the pharmacy lead who can assist with routine communication, practice changes, and stock updates.

Safety Considerations

- Compounding sodium chloride solutions from sterile water for injection and concentrated sodium chloride injection is labor-intensive and may worsen the existing shortage of concentrated sodium chloride injection. For urgent short-term sodium and fluid replacement therapy, consider adding concentrated sodium chloride to dextrose or other commercially available large volume parenterals.

- Avoid use of sodium chloride irrigation solution administered intravenously. Limits on particulate matter differ between these two products.

- Make sure all healthcare professionals administering medications have access to IV push policies and guidelines and have been trained and assessed for competency in administering medications via the IV push route. Use available best practices and concepts for IV push administration.[2]

- Consider an IV push administration competency assessment tool if one is not already in place.
- Do not allow the use of “stock” bags that could potentially be used for multiple patients.
- If transitioning medications to syringes for syringe infusion pump administration, make sure staff are adequately trained to use the technology.

External Resources

- Hurricane Helene Updates: Baxter Healthcare Corporation.
- Adult and pediatric IV push medication reference: Vizient, Inc. 2023
- ISMP Safe Practice Guidelines for Adult IV Push Medications: ISMP, 2015
- Intravenous Push Administration of Antibiotics: Hosp. Pharm, 2018.

Table 1. Comparison of Selected Intravenous Fluid[10-15]

Product	mOsm/L	Na (mEq/L)	Cl (mEq/L)	Dextrose (g/L)	K (mEq/L)	Ca (mEq/L)	Lactate (mEq/L)	Mg (mEq/L)	Ace-tate (mEq/L)	Gluconate (mEq/L)
0.9% Sodium Chloride	308	154	154	---	---	---	---	---	---	---
0.45% Sodium Chloride	154	77	77	---	---	---	---	---	---	---
Dextrose 5% plus 0.2% Sodium Chloride	321	34	34	50	---	---	---	---	---	---
Dextrose 5% plus 0.45% Sodium Chloride	406	77	77	50	---	---	---	---	---	---
Dextrose 5% plus 0.9% Sodium Chloride	560	154	154	50	---	---	---	---	---	---
Dextrose 5%	252	---	---	50	---	---	---	---	---	---
Lactated Ringers Solution	273	130	109		4	2.7	28	---	---	---
Lactated Ringers and Dextrose 5% Solution	525	130	109	50	4	2.7	28	---	---	---
Normosol-R	295	140	98	---	5	---	---	3	27	23
Plasmalyte-A	294	140	98	---	5	---	---	3	27	23

Table 2. Recommended Container Volumes Based on Infusion Rates

Infusion Rate	Bag Size
20 mL / hour or less	250 mL
21 mL/hour to 40 mL/hour	500 mL

Table 3. Considerations for Reserving Products for Selected Clinical Situations[16-18]

Clinical Situation	Product	Comments
Large volume replacement (surgery)	Lactated Ringers Solution	Large volumes of 0.9% sodium chloride may contribute to hyperchloremic acidosis.
Patients requiring sodium restriction	Dextrose 5% Solution	Select a fluid that contains little or no sodium.
Patients susceptible to hypoglycemia	Products containing Dextrose 5% Solution	Women and children may be more susceptible to hypoglycemia following fasts > 24 hours.
Pediatric patients requiring volume replacement	Sodium –free or low sodium IV solutions	Pediatric patients are susceptible to water intoxication and hyponatremia if sodium chloride replacement is inadequate[9]

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