HEMODYNAMIC SUPPORT AND IV FLUIDS

MITIGATION STRATEGIES FOR SCARCE RESOURCES

NORTHWEST HEALTHCARE Response Network.

Conventional Capacity – The spaces, staff, and supplies used are consistent with daily practices within the institution. These spaces and practices are used during a major mass casualty incident that triggers activation of the facility emergency operations plan.	**Contingency Capacity** – The spaces, staff, and supplies used are not consistent with daily practices, but provide care to a standard that is functionally equivalent to usual patient care practices. These spaces or practices may be used temporarily during a major mass casualty incident or on a more sustained basis during a disaster (when the demands of the incident exceed community resources)	**Crisis Capacity** – Adaptive spaces, staff, and supplies are not consistent with usual standards of care, but provide sufficiency of care in the setting of a catastrophic disaster (i.e., provide the best possible care to patients given the circumstances and resources available). Crisis capacity activation constitutes a significant and adjustment to standards of care (Hick et al, 2009).

RECOMMENDATIONS	***Strategy***	***Conventional***	***Contingency***	***Crisis***
Equipment and Supplies and Training 1. Cache intravenous (IV) cannulas, tubing, fluids, medications, and administration supplies, oral rehydration packets (ORS) and intraosseous (IO) equipment, including drill and manual placement needles. 2. Conduct training and education re: oral and enteral hydration, IO and hypodermoclysis fluid administration options. 3. Develop system wide scarce resource communication plans with clear lines of responsibility and accountability to keep staff aware of shortages and conservation strategies. 4. Consider centralized inventory control of critical medications and fluids (e.g. procedural areas, ORs, day surgery areas may have separate inventory control of critical resources).	*Prepare*			
IV Fluid Conservation Strategies[1] 5. Monitor CDC, FDA and ASHP updates on supply and conservation strategies. 6. Switch to oral therapy whenever possible (e.g. antibiotics, anticoagulants, electrolyte replacements).				
7. Discontinue KVO (Keep vein open) orders. 8. Adopt NPO strategies as recommended by the ASA[2] (2 hours for liquids, 4 hours for breast milk, 6 hours for infant formula, light meal or nonhuman milk) to limit "maintenance IVF". 9. Review electronic medical record order sets to ensure conservation strategies are being enforced. 10. If oral therapy is not feasible or indicated consider IM or SQ injection.				
11. If IV medications must be used, consider alternative compounding strategies to minimize IVF use such as syringe infusion pumps; IV push administration, following the "ISMP Safe Practice Guidelines for Adult IV Push Medications".[3] 12. Consider using alternative fluids (e.g. dextrose or LR), or other volume expanders (e.g. colloids) depending on clinical situation. 13. Repackage small bags from larger source following the "Repackaging of certain Human Drug Products by Pharmacies and Outsourcing Facilities" 2017, authored by FDA.[4]				
Emphasize Enteral Hydration Instead of IV Hydration **Provide oral hydration (ORT), when possible** 14. Provide guidelines for oral rehydration therapy, including indications for hospital referral, to outpatient providers. **Utilize Appropriate Oral Rehydration Solution** 15. Oral rehydration solution: 1-liter water (5 cups) + 1 tsp salt + 8 tsp sugar, add flavor (e.g., ½ cup juice) as needed. 16. Rehydration for moderate dehydration 50-100mL / kg over 2-4 hours. **Pediatric Hydration** Pediatric maintenance fluids: 17. Four mL/kg/h for first 10kg of body weight (40 mL/h for 1st 10 kg). 18. Two mL/kg/h for second 10kg of body weight (20 mL/h for 2nd 10kg = 60 mL/h for 20kg child). 19. One mL/kg/h for each kg over 20kg (example - 40 kg child = 60 mL/h plus 20 mL/h = 80 mL/h). Supplement for each diarrhea or emesis.	*Substitute*			
Provide nasogastric or gastrostomy (NG, G-tube) hydration for both adults and pediatric patients when applicable. 20. For fluid support, 8-12F (pediatric: infant 3.5F, < 2yrs 5F) tubes are better tolerated than standard size tubes. 21. For additional equipment size guidelines, refer to a pediatric length-based resuscitation tape, e.g., the Broselow™ Tape. NOTE: Clinical (urine output, etc.) and laboratory (BUN, urine specific gravity) assessments and electrolyte correction are key components of fluid therapy and are not specifically addressed by these recommendations.	*Substitute*			

IV and Syringe Pumps 22. Ensure IV pumps are charged and battery life monitored. 23. Consider stocking alternate emergency equipment for IV administration such as buretrols and drip counters, other devices such as the Drip Assist [T] designed for use in austere environments.	*Conserve*			
24. Reserve IV pumps, if limited, for use for critical medications such as sedatives, analgesics, certain antibiotics and hemodynamic support.	*Conserve*			
Substitute Epinephrine for Other Vasopressor Agents in Shortage 25. For hemodynamically unstable patients > 18 yo who are adequately volume-resuscitated, consider adding 6mg epinephrine (6mL of 1mg/ml) to1000mL NS on mini-drip tubing and titrate to target blood pressure. 26. For children < 18 yrs. add 0.6 X weight(kg) to equal total mg of Epinephrine to add to a 100 mL bag of NS. Run on mini-drip tubing start at 1 mL/hr (= 60 drips/hr or 1 drip/minute). This starting epinephrine rate = 0.1 mcg/kg/min, a standard starting epinephrine dose, assuming that 1 mL=60 drips for mini-drip tubing; increase drip rate to target blood pressure.	*Substitute*			
Re-use CVP, NG, and Other Supplies After Appropriate Sterilizations/Disinfection 27. In crisis situations, when considering re-use of otherwise single use disposable equipment, alternate sterilization techniques should be discussed using available expert opinions such as CDC, WHO, local public health and infection control specialists. When possible, consensus recommendation should be made. Possible sterilization options during crisis include: 27a) High-level disinfection for at least twenty minutes for devices in contact with body surfaces (including mucous membranes); glutaraldehyde, hydrogen peroxide 6%, or bleach (5.25%) diluted 1:20 (2500 ppm) may be acceptable solutions. NOTE: chlorine levels reduced if stored in polyethylene containers - double the bleach concentration to compensate).	*Re-use*			
Intraosseous and Subcutaneous (Hypodermoclysis) Replacement Fluids 28. Consider "clysis" as an option when alternative routes of fluid administration are impossible/unavailable. 29. Intraosseous administration should be considered before hypodermoclysis. **Intraosseous** 30. Intraosseous infusion is not generally recommended for hydration purposes, but may be used until alternative routes are available. Intraosseous infusion requires pump or pressure bag. Rate of fluid delivery is often limited by pain of pressure within the marrow cavity. This may be reduced by pre-medication with lidocaine (preservative-free) 0.5mg/kg slow IV push. **Hypodermoclysis** [5,6] 31. Cannot correct more than moderate dehydration via this technique. 32. Many medications cannot be administered subcutaneously. 33. Common infusion sites: pectoral chest, abdomen, thighs, upper arms. 34. Common fluids: normal saline (NS), D5NS, D5 1/2 NS (Can add up to 20-40 mEq potassium if needed.). 35. Insert 21/24 gauge needle into subcutaneous tissue at a 45 degree angle, adjust drip rate to 1-2 mL per minute (May use 2 sites simultaneously if needed.). 36. Maximal volume about 3 liters / day; requires site rotation. 37. Local swelling can be reduced with massage to area. 38. Hyaluronidase 150 units / liter facilitates fluid absorption but is not required; may not decrease occurrence of local edema.	*Substitute*			
Consider Use of Veterinary and Other Alternative Sources for Intravenous Fluids and Administration Sets	*Adapt*			

Adapted From the Minnesota Department of Health, Office of Emergency Preparedness

Updated: 10/02/2024

Next Update: 05/2027

[1] https://www.fda.gov/downloads/Drugs/DrugSafety/DrugShortages/UCM582461.pdf

[2] *http://anesthesiology.pubs.asahq.org/article.aspx?articleid=2596245&_ga=2.204142672.159725813.1522250986-851673073.1522250986*

[3] https://www.ismp.org/sites/default/files/attachments/2017-11/ISMP97-Guidelines-071415-3.%20FINAL.pdf

[4] *https://www.fda.gov/media/90978/download*

[5] *Caccialanza, R, et al, Subcutaneous Infusions of Fluids for Hydration or Nutrition: A Review, JPEN 2018;42:296-307*

[6] *Bruno, VG, Hypodermoclysis: a literature review to assist in clinical practice, Einstein (Sao Paulo) 2015;13(1):122-8*