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Clinical Considerations in the Conversion of Dextrose Injection USP to Glucose 50% Injection

The US Food and Drug Administration (FDA) has authorized the temporary importation of glucose products from outside the United States due to supply challenges stemming from Hurricane Helene. Please note that not all healthcare facilities will receive this product. Although glucose and dextrose are both manufactured with glucose as the source ingredient, glucose injections are not directly interchangeable with FDA-approved dextrose injection USP. These products have different concentrations, packaging, and labeling than US products. Members of the healthcare team should be educated on any differences between imported products and products FDA-approved for use in the US. Organizations must consider any differences between products (e.g., caloric content, concentration, osmolarity) and update protocols and systems accordingly (e.g., electronic health records, compounding systems). The Dear Healthcare Professional Letter accompanying the imported product must be read carefully. This tool is intended as a supplement to assist clinicians in the conversion of dextrose USP injection to glucose 50% injection and not as a replacement for FDA and manufacturer resources. This current IV fluid shortage is unprecedented and ASPEN is creating and updating materials as information becomes available.

Questions regarding these recommendations should be directed to clinicalpractice@nutritioncare.org.

Note: These recommendations do not constitute medical or other professional advice and should not be taken as such. To the extent that the information published herein may be used to assist in the care of patients, the primary component of quality medical care is the result of the professional judgment of the healthcare professionals providing care. The information presented here is not a substitute or replacement for the exercise of professional judgment by healthcare professionals; rather, it is intended to supplement professional training and judgment. Circumstances and patient specifics in clinical settings may require actions different from those recommended in this document; in those cases, the judgment of the treating professionals should prevail. Use of this information does not in any way guarantee any specific benefit in outcome or survival.

These shortage recommendations are intended only for use during product shortages, when adequate product is unavailable. These measures are not ideal for ensuring safe and optimal patient care and should not be considered standard practice. Any deviation from manufacturer-recommended practices should be temporary and reversed once adequate product supply is restored. No single strategy will work for all organizations. Institutions must carefully evaluate each option, weighing potential risks and benefits before implementation. These recommendations are provided with the understanding that they are followed at the institution's own risk, and each organization assumes responsibility for any resulting outcomes.

What Is the Difference Between Dextrose USP and Glucose Injection?

The most commonly used intravenous carbohydrate energy substrate in the US is dextrose injection USP. Dextrose injection USP is a hydrous form of glucose and provides 3.4 kilocalories (kcal)/g in its hydrated (D-glucose monohydrate) form.

The imported glucose injection product is labeled based on the anhydrous (D-glucose) form of glucose and provides 3.75 kcal/g.[1]

Dextrose injection USP	Glucose injection
3.4 kcal/g	3.75 kcal/g*
Hydrous form	Anhydrous form

*The glucose injection label and Dear Healthcare Professional Letter indicate that glucose injection provides 4 kcal/g; this discrepancy is due to a rounded calculated value. However, 3.75 kcal/g is the most precise value per the manufacturer.[1]

Since glucose injections are provided in anhydrous form (no water molecule; only glucose), at the same concentration, glucose injections provide a higher kcal and osmolarity content per gram than dextrose USP injections. Therefore, these products are not directly interchangeable at the same concentration (e.g., dextrose 50% ≠ glucose 50%).

Converting Dextrose Injection USP to Glucose 50% Injection

As previously mentioned, these products are not directly interchangeable. However, Glucose 50% is clinically equivalent to Dextrose 55% USP. This means a conversion factor of 1.1 can be used to determine a calorically equivalent dose. Ultimately, because of the additional water content in Dextrose USP, more grams of Dextrose USP are needed to provide a calorically equivalent dose of the Glucose product:

a. Dextrose 55% USP = Glucose 50%
    a. 55 / 50 = 1.1

Patients converting from Dextrose Injection USP to Glucose Injection need **1.1 times *fewer*** grams of the glucose product to provide an equivalent dose of dextrose. This conversion factor can be used to determine the equivalent glucose injection product for patients needing to convert from dextrose injection USP to glucose injection by dividing the grams of dextrose by 1.1. With accurate conversion, the calories and osmolarity between the products will be roughly equal (minor differences will be noted due to rounding).

Stability and Compatibility Considerations

Glucose and dextrose are both manufactured with glucose as the source ingredient; therefore, stability and compatibility considerations between the products are not expected to differ ***if*** the calorically equivalent dose of dextrose is utilized (Glucose 50% = Dextrose 55%). Assessment of compatibility and stability should be made on the final concentration of the admixture (US resources are based on the final concentration of dextrose). Please refer to the product manufacturer resources for additional information on stability and compatibility.

Volume Considerations

Most parenteral nutrition (PN) in the US is compounded using Dextrose 70% USP. As demonstrated in the case examples below, more *volume* of the Glucose 50% product is required to provide a calorically equivalent dose of Dextrose 70% (because Glucose 50% is less concentrated than Dextrose 70%). The volume difference, however, will depend on the dextrose concentration typically available at your healthcare facility. Less sterile water for injection may be required during PN compounding when substituting Glucose 50% for higher concentrations of dextrose. Take caution in providing additional fluid in PN to patients with disorders of fluid balance and adjust sterile water for injection and other PN components accordingly.

Case Examples

Case #1: Adult patient

A 70 kg adult male is currently receiving 250 g of Dextrose 70% in PN. Due to a shortage, Dextrose 70% is unavailable, but Glucose 50% is available as an alternative product. How many grams of Glucose 50% are calorically equivalent to 250 g of Dextrose 70%?

(*Answer: 227 g Glucose 50%*)

1. If Glucose 50% (50 g/100 mL) is equivalent to Dextrose 55% (55 g/100 mL), a conversion factor of 1.1 can be used to determine a calorically equivalent dose (see 'Converting Dextrose Injection USP to Glucose 50% Injection'):
    a. 55 g / 50 g = 1.1
2. If a patient is currently receiving 250 g dextrose, **1.1 times *fewer*** grams of glucose are needed to provide a calorically equivalent dose. Divide the g of dextrose by 1.1 to calculate the calorically equivalent dose:
    a. 250 g dextrose / 1.1 = 227 g Glucose
3. Check your work to determine whether the caloric value provided by each product/dose is equivalent:
    a. 250 g dextrose x 3.4 kcal/g = 850 kcal from dextrose
    b. 227 g glucose x 3.75 kcal/g = 851 kcal from glucose
4. Note the volume differences provided by each product. More volume of the Glucose 50% product is required to provide a calorically equivalent dose of Dextrose 70%. However, the volume difference will depend on the dextrose concentration typically used at your healthcare facility.
    a. 250 g Dextrose 70% (70 g/100 mL) = 357 mL
    b. 227 g Glucose 50% (50 g/100 mL) = 454 mL

Case #2: Neonatal patient

A 3 kg neonatal patient is receiving a glucose infusion rate (GIR) of 12 mg/kg/min, and Dextrose 70% is used for compounding. Due to a shortage, Dextrose 70% becomes unavailable, and Glucose 50% must be substituted. How many grams of Glucose 50% are calorically equivalent to the Dextrose 70% provided with a GIR of 12 mg/kg/min?

(*Answer: 47 g Glucose 50%)*

1. If Glucose 50% (50 g/100 mL) is equivalent to Dextrose 55% (55 g/100 mL), a conversion factor of 1.1 can be used to determine a calorically equivalent dose (see 'Converting Dextrose Injection USP to Glucose 50% Injection'):
    a. 55 g / 50 = 1.1
2. Calculate the grams of dextrose per day that correspond to a GIR of 12 mg/kg/min:
    a. GIR calculation (mg/kg/min) = [dextrose (g/day) x 1000] / [24 (hours/day) x 60 (min/hour) x weight (kg)]
    b. GIR 12 mg/kg/min = [*52 g dextrose/day* x 1000] / [24 hours x 60 min x 3 kg]
3. If a patient is currently receiving 52 g dextrose, **1.1 times *fewer*** grams of glucose are needed to provide a calorically equivalent dose. Divide the g of dextrose by 1.1 to calculate the calorically equivalent dose:

   a. 52 g dextrose / 1.1 = 47 g glucose

4. Check your work to determine whether the caloric value provided by each product/dose is equivalent:
   a. 52 g dextrose x 3.4 kcal/g = 177 kcal from dextrose
   b. 47 g glucose x 3.75 kcal/g = 176 kcal from glucose
5. Note the volume differences provided by each product. More volume of the Glucose 50% product is required to provide a calorically equivalent dose of Dextrose 70%. However, the volume difference will depend on the dextrose concentration typically used at your healthcare facility.
   a. 52 g Dextrose 70% (70 g/100 mL) = 74 mL
   b. 47 g Glucose 50% (50 g/100 mL) = 94 mL
6. Note the GIR value will be lower when substituting a calorically equivalent amount of glucose for dextrose in the equation, but the delivery of glucose mg/kg/min will be equivalent to that of dextrose. Therefore, clinicians should use the equivalent grams of dextrose when calculating GIR.

Summary of Clinical Considerations

1. Glucose injections are not directly interchangeable with FDA-approved dextrose injection USP.
2. Glucose 50% is equivalent to Dextrose 55% USP. An appropriate conversion must be made to provide a calorically equivalent dose when using Glucose 50% in place of dextrose.
3. **Clinicians can convert dextrose injection USP to glucose 50% by dividing the grams of dextrose by 1.1** (see 'Converting Dextrose Injection USP to Glucose 50% Injection').
4. **Dextrose Injection USP provides 3.4 kcal/g and Glucose Injection provides 3.75 kcal/g. The** glucose injection label and Dear Healthcare Professional Letter indicate that glucose injection provides 4 kcal/g; this discrepancy is due to a rounded calculated value. However, 3.75 kcal/g is the most precise value per the manufacturer.
5. More volume of the Glucose 50% product is required to provide a calorically equivalent dose of Dextrose 70% (product typically used in the US for PN compounding). The actual volume difference will depend on the dextrose concentration typically used at your healthcare facility.

Resources:

1. Dear Healthcare Professional Letter
2. Baxter Resources for Products Authorized for Temporary Importation
3. FDA – Hurricane Helene Updates
4. ISMP Medication Errors Reporting Program

References

1. Merrill AL, Watt BK. Energy value of foods- basis and derivation. Human Nutrition Research Branch Agricultural Research Service US Department of Agriculture. Agriculture Handbook No 74. 1973.

About ASPEN

The American Society for Parenteral and Enteral Nutrition (ASPEN) is dedicated to improving patient care by advancing the science and practice of nutrition support therapy and metabolism. Founded in 1976, ASPEN is an interdisciplinary organization whose members are involved in the provision of clinical nutrition therapies, including parenteral and enteral nutrition. With members from around the world, ASPEN is a community of dietitians, nurses, nurse practitioners, pharmacists, physicians, PAs, researchers, scientists, and students from every facet of nutrition support clinical practice, research, and education. For more information about ASPEN, please visit www.nutritioncare.org.