



## Ketogenic Diet Considerations for Surgeries & Procedures

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*This information should not replace guidance from a health care professional managing the care of your child or loved one. Caregivers should use this guide to help inform conversations as part of the health care team, working with medical professionals to determine the best course of action given the individual patient's medical history and the intended outcome of each procedure.*

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**If a patient is currently on a special diet (such as the ketogenic, low glycemic, or modified Atkins diet) what are some things I should know?**

### **On Admission**

You should provide the surgical team with the following information:

- Information about their specific ketogenic regimen
- Nutritional status
- Caloric intake
- Contact information for their ketogenic dietitian / hospital team.
- Blood glucose and ketone testing equipment (if they use this at home).

Make sure the team places a glucose/dextrose allergy as an extra precaution to prevent carbohydrate containing products from being given.

### **Before Surgery**

Before surgery, the patient may be placed NPO, or nothing by mouth. Instead of food, they will have continuous carbohydrate free IV fluids.

The following measurements may be taken before surgery:

- Weight
- Urine ketones
- Complete blood cell count
- Basic metabolic panel to assess serum electrolytes, bicarbonate, calcium, magnesium, albumin, prealbumin levels and kidney function
- Blood gases such as pH and bicarbonate to assess acid-base safety
- Liver function tests
- Lactate
- B-hydroxybutyrate

If the patient was experiencing side effects to the ketogenic diet, the following should be tested before surgery:

- Electrocardiogram
- Lipid profile
- Urinalysis

## During Surgery

The goals during surgery include:

- Maintaining ketosis
- Avoiding high carbohydrate content
- Keeping the patient's serum glucose, electrolytes, and pH stable

Patients will be placed on continuous carbohydrate-free IV fluids during surgery as well. Normal saline is preferred. There have not been many studies on ketogenic patients in surgery, but the largest study to date found that patients on the ketogenic diet can safely stay on carbohydrate-free IV fluids for procedures lasting less than 1.5 hours. For procedures lasting more than 3 hours the most common side effect is a significant decrease in pH. The surgical team can help keep the pH stable by giving IV bicarbonate. It is important that blood pH and bicarbonate are monitored during procedures lasting more than 3 hours and that IV bicarbonate is administered where necessary.

## Monitoring During Surgery

Every 2-3 hours these measurements should be taken:

- pH
- Glucose (treat if <40 mg/dL and symptomatic)
- Bicarbonate
- Electrolytes

## Medications

Patients may need some IV medications. Make sure to let your surgical team know that the patient cannot have dextrose or glucose.

**The following medications should be prepared in normal saline instead of dextrose:**

Medication	Diluent	Medication (continued)	Diluent
Acetazolamide (Diamox <sup>®</sup> )	D5W or NS	Lacosamide (Vimpat <sup>®</sup> )	No dilution needed
Acyclovir (Zovirax <sup>®</sup> )	D5W or NS	Leucovorin	D5W or NS
Amikacin (Amikin <sup>®</sup> )	D5W or NS	Levetiracetam (Keppra <sup>®</sup> )	No dilution needed
Amphotericin B (Ambisome <sup>®</sup> )	D5W only	Levocarnitine	NS only
Ampicillin	Sterile water	Levofloxacin (Levaquin <sup>®</sup> )	D5W or NS
Ampicillin/sulbactam (Unasyn <sup>®</sup> )	D5W or NS	Linezolid (Zyvox <sup>®</sup> )	D5W or NS
Azithromycin (Zithromax <sup>®</sup> )	D5W or NS	Lorazepam (Ativan <sup>®</sup> )	No dilution needed
Aztreonam (Azactam <sup>®</sup> )	D5W or NS	Magnesium sulfate	D5W or NS
Calcium chloride	D5W or NS	Meperidine (Demerol <sup>®</sup> )	D5W or NS
Calcium gluconate	D5W or NS	Meropenem (Merrem <sup>®</sup> )	D5W or NS
Cefazolin (Ancef <sup>®</sup> )	D5W or NS	Methadone (Methadose <sup>®</sup> )	NS only
Cefepime (Maxipime <sup>®</sup> )	D5W or NS	Methylprednisolone (Solumedrol <sup>®</sup> )	D5W or NS
Cefoxitin (Mefoxin <sup>®</sup> )	D5W or NS	Metronidazole (Flagyl <sup>®</sup> )	No dilution needed
Ceftaroline (Teflaro <sup>®</sup> )	D5W or NS	Micafungin (Mycamine <sup>®</sup> )	D5W or NS
Ceftazidime (Fortaz <sup>®</sup> )	D5W or NS	Midazolam (Versed <sup>®</sup> )	D5W or NS
Ceftriaxone (Rocephin <sup>®</sup> )	D5W or NS	Milrinone (Primacor <sup>®</sup> )	D5W
Ciprofloxacin (Cipro <sup>®</sup> )	D5W or NS	Morphine	D5W or NS
Cisatracurium (Nimbe <sup>®</sup> )	D5W or NS	Norepinephrine (Levophed <sup>®</sup> )	D5W or NS
Clindamycin (Cleocin <sup>®</sup> )	D5W or NS	Ondansetron (Zofran <sup>®</sup> )	D5W or NS
Daptomycin (Cubici <sup>®</sup> )	NS only	Oxacillin (Bactocil <sup>®</sup> )	D5W or NS
Dexamethasone (Decadron <sup>®</sup> )	D5W or NS	Pantoprazole (Protonix <sup>®</sup> )	NS
Dexmedetomidine (Precedex <sup>®</sup> )	NS	Pentobarbital (Nembutal <sup>®</sup> )	D5W or NS
Diazepam (Valium <sup>®</sup> )	No dilution needed	Peramivir (Rapivab <sup>®</sup> )	D5W or NS
Doxycycline (Vibramycin <sup>®</sup> )	D5W or NS	Phenylephrine	D5W or NS
Epinephrine	D5W or NS	Phenytoin (Dilantin <sup>®</sup> )	NS
Ertapenem (Invanz <sup>®</sup> )	NS only	Piperacillin/tazobactam (Zosyn <sup>®</sup> )	D5W or NS
Erythromycin	D5W or NS	Prochlorperazine (Compazine <sup>®</sup> )	D5W or NS
Fentanyl (Sublimaze <sup>®</sup> )	D5W or NS	Propofol (Diprivan <sup>®</sup> )	No dilution
Fluconazole (Diflucan <sup>®</sup> )	D5W or NS	Rocuronium (Zemuron <sup>®</sup> )	D5W or NS
Folic acid	D5W or NS	Succinylcholine (Anectin <sup>®</sup> )	No dilution needed
Fosphenytoin (Cerebryx <sup>®</sup> )	D5W or NS	Tigecycline (Tygacil <sup>®</sup> )	D5W or NS
Ganciclovir (Zirgan <sup>®</sup> )	D5W or NS	Tobramycin	D5W or NS
Gentamicin	D5W or NS	Trimethoprim/sulfamethazole (Bactrim <sup>®</sup> )	D5W or NS
Glycopyrrolate (Robinul <sup>®</sup> )	D5W or NS	Valproic acid (Depacon <sup>®</sup> )	D5W or NS
Granisetron (Kytri <sup>®</sup> )	D5W or NS	Vancomycin (Vancocin <sup>®</sup> )	D5W or NS
Hydrocortisone (Solu-Cortef <sup>®</sup> )	D5W or NS	Vasopressin (Pitressin <sup>®</sup> )	D5W or NS
Iron sucrose (Venofer <sup>®</sup> )	NS only	Vecuronium (Nocuron <sup>®</sup> )	D5W or NS
Ketamine (Ketalar <sup>®</sup> )	D5W or NS	Voriconazole (Vfend <sup>®</sup> )	D5W or NS

**Abbreviations: NS=normal saline, D5W= dextrose 5% in sterile water**

Steroids such as dexamethasone may increase blood glucose levels. Blood glucose should be monitored and other options should be explored to help with the interruption in ketosis.

## Transfusions

Transfusion of blood products (including whole blood, packed red blood cells, fresh frozen plasma, and cryoprecipitate) might contain significant and variable amounts of carbohydrate both from the donor's plasma and preservative solutions. Although transfusion may lead to loss of ketosis, it should not be withheld based on that alone.

## After Surgery

- Continue continuous carbohydrate free IV fluids and advance diet as tolerated.
- Continue monitoring pH and bicarbonate as clinically indicated.
- Restart ketogenic diet as soon as possible.

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Questions? Email: [veronica@dravetfoundation.org](mailto:veronica@dravetfoundation.org)

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## References

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