Ketogenic Therapy: Initiation – Adult – Inpatient
Clinical Practice Guideline

Note: Active Table of Contents – Click each header below to jump to the section of interest

Table of Contents
INTRODUCTION ............................................................................................................. 3
SCOPE ............................................................................................................................ 3
DEFINITIONS ................................................................................................................. 4
RECOMMENDATIONS ................................................................................................... 5
  1. Prior to Starting Ketogenic Therapy ................................................................. 5
  2. Contraindications for Ketogenic Therapy ....................................................... 5
  3. Initial Steps - Preparing for Ketogenic Therapy .............................................. 6
  4. Initial Steps – Removing Carbohydrate from Medications ............................. 7
  5. First 24 Hours - Initiating KT ......................................................................... 8
  6. Blood Glucose Monitoring on KT ................................................................. 8
  7. KT Maintenance for Patients who Start KT in the Hospital .......................... 9
  8. Managing Side Effects .................................................................................. 9
  9. Upon Transfer to General Care .................................................................... 10
 10. Upon Discharge to Rehabilitation or Home ................................................ 11
METHODOLOGY .......................................................................................................... 12
APPENDIX A. PHARMACEUTICAL INGREDIENTS .................................................. 14
REFERENCES: ............................................................................................................ 15
Content Expert:
Name: Elizabeth Felton, MD, PhD - Neurology
Phone Number: (608) 263-0755
Email Address: felton@neurology.wisc.edu

Contact for Changes:
Name: Center for Clinical Knowledge Management (CCKM)
Email Address: CCKM@uwhealth.org

Guideline Author(s):
Elizabeth Felton, MD, PhD – Neurology
Kelly Faltersack, MS, RD, CD – Clinical Nutrition

Workgroup Members:
Elizabeth Felton, MD, PhD – Neurology, CPG champion
David Hsu, MD, PhD – Pediatric Neurology
Joshua Medow, MD – Neuro ICU Director
Robin Crist, MS, RD, CD, CNSC – Clinical Nutrition Manager
Kelly Faltersack, MS, RD, CD – Clinical Nutrition
Emily Wallace, MS, RD, CD, CNSC – Clinical Nutrition Manager
Carin Bouchard, PharmD – Pharmacy
Lisa Hawk, PharmD – Pharmacy
David Yang, MD – Lab

Reviewers:
Rama Maganti, MD – Neurology, Epilepsy Division Head
Meghan Furstenberg-Knauff, NP – Pediatric Neurology
Cheryl Hoeth, RHIT, CCS, MBA, FACMPE, FACHE – Neurology & Neurosurgery Service Line Director
Julie Beich – Nutrition Technician Supervisor
Eileen (Ellie) Burgenske, RN – F8/4 and D6/4 CNS
Patricia Chesmore, RN – F8/4 Unit Manager
Amy Alexander, RN – D6/4 Unit Manager
Philip Trapskin, PharmD – Pharmacy
Barbara Liegel, MS, RN – Case Management

Committee Approval(s):
Nutrition Committee (Last Periodic Review: 02/15/18)
Clinical Knowledge Management (CKM) Council (03/22/18)
Introduction
Ketogenic Therapy (KT) utilizing the ketogenic diet (KD) has a long-established success in treating adults and children with refractory epilepsy.\textsuperscript{1-3} The KD is a high fat, low carbohydrate medical nutrition therapy designed to mimic the fasting state with the goal of inducing ketosis by using fat for energy. While the specific mechanisms are still unknown, the state of ketosis is associated with seizure reduction or elimination in patients with epilepsy.\textsuperscript{4,5} More recently, there has also been success in the use of KT as an emergent, acute therapy in adults with status epilepticus (SE).\textsuperscript{6-9}

KT requires vigilance on the part of a multidisciplinary team to safely maintain therapy and prevent excess carbohydrate administration\textsuperscript{10}. Once SE is resolved and patients are taking food by mouth, they can be transitioned to the modified Atkins diet (MAD) while maintaining seizure control and minimizing medical comorbidities to facilitate recovery.\textsuperscript{7}

There are potential side effects from KT which require monitoring. Side effects associated with KT are usually gastrointestinal related, with constipation being the most common. The risk of serious adverse events, however, is low and KT does not need to be discontinued for most patients.

Status epilepticus (SE), as defined by the International League Against Epilepsy (ILAE) Task Force on Classification of Status Epilepticus is: “a condition resulting either from the failure of the mechanisms responsible for seizure termination or from the initiation of mechanisms, which lead to abnormally, prolonged seizures (after time point t1). It is a condition, which can have long-term consequences (after time point t2), including neuronal death, neuronal injury, and alteration of neuronal networks, depending on the type and duration of seizures.”\textsuperscript{11} Time points 1 (t1) and 2 (t2) respectively are: 5 and 30 minutes for convulsive status epilepticus, 10 and >60 minutes for focal status epilepticus with impaired consciousness, and 10-15 minutes and unknown for absence status epilepticus. Status epilepticus is considered a neurological emergency, with a mortality rate of 26% in adults.\textsuperscript{12} The overall (all ages) incidence is 9.9 to 41 per 100,000 per year.

Scope

Intended Users: Any physician, advanced practice provider, registered nurse, respiratory therapist, pharmacist, registered dietitian, nutrition technician, speech therapist, nursing assistant or medical assistant caring for a patient receiving KT.

Objective(s): To provide evidence-based guidelines for health care professionals responsible for the care of patients for whom KT will be initiated, maintained, and/or weaned on an emergent basis.

Target Population: Adult (18 years or older) inpatients in status epilepticus (the primary use of this protocol), but also for limited use for patients with intractable epilepsy or a condition where an emergent inpatient start is deemed appropriate by the KT team. This protocol may also be used for adults already on ketogenic therapy who present for hospital admission.

Clinical Questions Considered:
- What are contraindications for starting KT for adults?
- How should the ketogenic diet be initiated for adults?
Should the ketogenic diet be transitioned once no longer in status epilepticus?

**Definitions**

Status Epilepticus (SE) – From International League Against Epilepsy (ILAE) Task Force on Classification of Status Epilepticus: “Status epilepticus is a condition resulting either from the failure of the mechanisms responsible for seizure termination or from the initiation of mechanisms, which lead to abnormally, prolonged seizures (after time point t1). It is a condition, which can have long-term consequences (after time point t2), including neuronal death, neuronal injury, and alteration of neuronal networks, depending on the type and duration of seizures.”

Time points 1 (t1) and 2 (t2) respectively are: 5 and 30 minutes for convulsive status epilepticus, 10 and >60 minutes for focal status epilepticus with impaired consciousness, and 10-15 minutes and unknown for absence status epilepticus.

Refractory Status Epilepticus (RSE) – Status epilepticus that continues despite therapy with benzodiazepines and intravenous anti-seizure medications (e.g. phenytoin, phenobarbital, or valproate). General anesthesia is typically recommended at this point.

Super Refractory Status Epilepticus (SRSE) – Status epilepticus that continues or recurs 24 hours or more after the onset of anesthetic therapy, including cases that recur upon the reduction or withdrawal of anesthesia.

Ketogenic Therapy (KT) or Ketogenic Diet (KD) - A high fat, low carbohydrate, adequate protein medical nutrition therapy used to induce and maintain a state of ketosis by using fat as the primary energy substrate, similar to fasting or starvation, while maintaining nutritional status.

Classic Ketogenic Diet (classic KD) – The original ketogenic therapy which is high in fat and low in carbohydrates to induce ketosis. Typically, there is either a 4:1 or 3:1 ratio of grams of fat to grams of carbohydrates + protein. This version of KT can be administered orally or enterally.

Intractable or drug-resistant epilepsy - Failure of adequate trials of at least two tolerated and appropriately chosen and used anti-seizure drugs.

Modified Atkins Diet (MAD) – Another ketogenic therapy for epilepsy, which is also high in fat and low in carbohydrates to induce ketosis. MAD is commonly used in adults as it is slightly more liberalized than the classic KD, allowing 10-20 grams of carbohydrate intake daily. This version of KT is typically administered orally.

Ketosis – A condition characterized by elevated levels of ketones in the body, associated with fat metabolism. The state of ketosis is thought to lead to seizure reduction in patients with epilepsy on ketogenic therapy.

Ketones – Refers to the three types of ketone bodies - acetoacetate, acetone, and beta-hydroxybutyrate. These are produced when the body metabolizes fat for energy. They are typically measured in the urine and serum, although there are also breath ketone analyzers.

- **Urine Ketones** – Most commonly used to measure ketones in patients following KD or MAD. It is measured using urine dipsticks coated with chemicals that react with ketone bodies. A goal of 80 mg/dL to 160 mg/dL, or moderate to large ketones, is desired while on ketogenic therapy.

- **Blood Ketones** – May be measured using a finger stick test or blood draw. Typically measures beta-hydroxybutyrate (BHB). Requires interpretation by KT team.
Recommendations

1. Prior to Starting Ketogenic Therapy

Basic steps prior to considering KT are described below. It is important for baseline height and weight to be obtained for accurate calculation of estimated energy and protein needs. Baseline laboratory values are important to help determine if a patient is stable enough to initiate KT.

Steps prior to considering ketogenic therapy\(^7,14\)
(UW Health Moderate quality evidence, strong recommendation)

1. Obtain baseline weight using standing scale or zeroed bed scale.
2. Obtain baseline height using a tape measure.
3. Obtain baseline laboratory values, which include:
   a. Fasting lipid profile
   b. Comprehensive metabolic panel (CMP)
   c. Complete blood count (CBC)
   d. Magnesium
   e. Phosphorus
   f. Carnitine – total and free
   g. Urinalysis
   h. Urine calcium (random, 24 hour not needed)
   i. Urine creatinine (random, 24 hour not needed)
   j. Lipase
   k. 25-hydroxy vitamin D
   l. International normalized ratio (INR)
   m. Pregnancy test (women)
4. Additional baseline labs to consider (per discretion of ketogenic team, may not always be needed)
   a. Urine organic acids
   b. Serum amino acids
5. Maintain continuous video EEG (standard for patients in status epilepticus, may not be needed if patient is not in status epilepticus).
6. Discontinue propofol infusion 24 hours prior to initiation of KT (see explanation below).

Propofol-related infusion syndrome (PRIS), a rare but potentially fatal side effect of propofol, can include unexplained metabolic acidosis, rhabdomyolysis, hepatomegaly, renal failure, hyperlipidemia, arrhythmia, and progressive myocardial failure.\(^15\) In one case report, the ketogenic diet in combination with intravenous propofol was thought to provoke a fatal PRIS.\(^16\) For this reason, propofol should be discontinued 24 hours prior to initiating KT.

2. Contraindications for Ketogenic Therapy

Contraindications for starting KT are described below. These include a list of lab abnormalities; however, many of these abnormalities do not preclude a patient from KT indefinitely. In many situations, KT can be initiated once laboratory abnormalities are corrected, and per discretion of KT and treatment team.
Contraindications for initiating ketogenic therapy in the acute setting\textsuperscript{7,14,17}
\textit{(UW Health Moderate quality evidence, strong recommendation)}

- Unstable metabolic condition, for example:
  - persistent hyponatremia (sodium < 130 mg/dL)
  - severe hypernatremia (sodium > 150 mg/dL)
  - hypocalcemia (albumin corrected calcium <8 mg/dL)
  - hypoglycemia (glucose < 50 mg/dL)
  - acidosis (pH < 7.2) for 24 hours
- Hemodynamic or cardiorespiratory instability (MAP consistently < 60, persistent tachycardia> 120 beats per minute, patient requiring high dose pressors)
- Coagulopathy (INR > 1.5 and/or on anticoagulation) should be reviewed by physician, but is not an absolute contraindication
- Liver failure (AST, ALT, ammonia > 5 x upper limits of normal, hyperbilirubinemia- total bilirubin > 15 mg/dL, direct bilirubin > 5 mg/dL)
- Potential pancreatitis (lipase > 5x upper limits of normal)
- Total cholesterol > 300 mg/dL should be reviewed by physician, but is not an absolute contraindication
- Inability to tolerate enteral nutrition, i.e., ileus
- Known pregnancy or positive pregnancy test
- Any propofol infusions within 24 hours
- Diagnosis of diabetes should be reviewed by physician, but is not an absolute contraindication

Absolute contraindications (will not resolve)\textsuperscript{14}

- Known primary carnitine deficiency, carnitine palmitoyltransferase (CPT) I or II deficiency, carnitine translocase deficiency, beta-oxidation defects, pyruvate carboxylase deficiency, or porphyria

3. Initial Steps - Preparing for Ketogenic Therapy

The initial steps to prepare a patient for KT initiation are described below. These initial steps involve removing dextrose from IV fluids, minimizing or eliminating carbohydrates from medications and personal care items, and preparing for the administration of a ketogenic formula. Maintenance fluids should be started because they are important to help reduce the risk of constipation, dehydration and kidney stones. In addition, vitamin and mineral supplements should be started, which is standard for patients on KT.

Initial steps when ready to start ketogenic therapy\textsuperscript{7}
\textit{(UW Health Moderate quality evidence, strong recommendation)}

1. Avoid IV dextrose when administering IV fluids.
   a. If IV fluids are necessary, provide dextrose free solutions: normal saline, ½ normal saline, or lactated ringers.
   b. If NPO, ensure blood glucose is being monitored (see Blood Glucose Monitoring section below for treatment parameters once on KT).
   c. Fluids containing 2.5% or 5% dextrose should only be used during extended periods of NPO (>15 hours) with the guidance and agreement of the KT team.
2. Discontinue / minimize carbohydrate containing medications and personal care products (also see additional information in next section and Appendix A).
   a. Minimize carbohydrate containing medications, especially syrups, elixirs or chewable tablets (e.g., Tums).
   b. Contact pharmacist (inpatient or outpatient as appropriate) for assistance with determining the lowest carbohydrate medication options.

3. Tube placement for enteral feeding (if applicable).

4. Discontinue current enteral formula (if applicable).

5. Start maintenance fluids. All KT patients should receive at least maintenance fluids by mouth or via feeding tube, intravenously, or through a combination of both. Maintenance fluids are calculated per individualized maintenance needs per the KT team.

6. Begin supplements: multivitamin with minerals, calcium, and vitamin D. If given via tube, these should be CRUSHED TABLETS.

7. Order a Nutrition consult and answer “yes” to “delegate to initiate and manage tube feeding.”

4. Initial Steps – Removing Carbohydrate from Medications

In addition to IV fluids, medications can provide a significant amount of carbohydrate. The impact of carbohydrate changes in medications can disrupt ketosis leading to seizure activity. The carbohydrate content in medications can be most accurately determined using information on digestible and indigestible carbohydrates versus total carbohydrates. However, as this information is not always readily available on packaging, a list of carbohydrate containing some common ingredients in medications can be found in Appendix A. This list can be used to determine medications with lower carbohydrate content. In general, non-carbohydrate containing medications should be used when possible. When not possible, use of the lowest carbohydrate product possible is essential to ensuring the patient gets into ketosis.

In general, syrups, solutions, elixirs, and chewable tablets contain more carbohydrate than tablets, therefore use should be limited. All existing and new medications should be evaluated by the inpatient pharmacist to determine lowest carbohydrate form available prior to administering. Commonly ordered medication injections/infusions may contain dextrose, typically in the base solution the drug is diluted in. The base solution of an infusion should be changed to 0.9% sodium chloride or straight drug whenever possible.

Sugar-free is not always equivalent to carbohydrate-free and thus is not always the lowest carbohydrate option. Sugar-free medications often contain sugar alcohols, such as sorbitol, glycerol, xylitol, maltitol, erythritol, and isomalt. In the case of many medication solutions and suspensions, the active ingredient is commonly mixed with sugar alcohol. Sugar alcohols are not metabolized by the digestive tract, and thus have no effect on blood glucose. However, sugar alcohols are believed to interfere with the production of ketones, therefore use is not recommended in KD.
5. **First 24 Hours - Initiating KT**

**Starting ketogenic therapy via tube feed**
(UW Health Moderate quality evidence, strong recommendation)

1. Once feeding tube placement has been confirmed, begin ketogenic formula as specified by the KT treatment team.

2. Calorie and protein provision are at the discretion of the KT dietitian. Supplemental protein is generally not required. Due to the critical nature of SE, the focus is on achieving ketosis. Protein needs may not be met in the short term.

3. Provide additional enteral water flushes and/or IV fluids to meet maintenance fluid needs, unless fluid restriction is warranted per KT treatment team.

4. Consider obtaining indirect calorimetry if possible.

**Starting ketogenic therapy by mouth (if applicable)**
(UW Health Moderate quality evidence, strong recommendation)

1. Patient will begin KT with the modified Atkins diet (MAD) at 20 grams of net carbohydrates per day.
   a. Please order “Ketogenic” diet order and make patient “RS-2.” Carbohydrate counts should also be ordered.
   b. Nutrition technician will assist with meal planning while in the hospital as needed. Patients who were on MAD prior to admission have experience managing the diet on their own and may choose to order their own meals rather than working with the nutrition technician if desired. Ketogenic diet menus are available for patients and list the grams of net carbohydrates per serving.

6. **Blood Glucose Monitoring on KT**

Please note that the definition of hypoglycemia for patients on KT is different than that for general patients. Typically, hypoglycemia is thought to be a blood glucose less than 70 mg/dL; however, for patients on KT, we only treat for glucose less than 50 mg/dL.

**Recommendations for blood glucose monitoring**
(UW Health GRADE Moderate quality evidence, strong recommendation)

1. If tube fed, check Point of Care (POC) glucose every 6 hours until tube feeding is at goal rate, then as ordered.

2. If a patient fails to maintain their feeding regimen as prescribed or requires NPO status, blood glucose monitoring is indicated.

3. Blood glucose goal: >50 mg/dL
   a. If blood glucose <50 mg/dL, treat initially with 12.5 g IV dextrose (e.g. 25 mL D50%) and recheck glucose in 15 minutes.
   b. Additional treatment will be based upon effect of initial dose. Repeated treatment may not be warranted if glucose is showing a positive trend. Overtreatment may cause glycemic excursions that can disrupt treatment goals.

Blood glucose levels in patients receiving KT are often lower than the general population (50-75 mg/dL). Any blood glucose level <50 mg/dL is to be treated accordingly, applying the above
guidelines for ketogenic patients. A set dose of 12.5 g of IV dextrose should be used regardless of weight. Providing a dose based on weight would potentially provide more dextrose than needed, possibly weaken ketosis and increase seizure activity.7

7. KT Maintenance for Patients who Start KT in the Hospital

Maintaining ketogenic therapy after initial start7
(UW Health GRADE Moderate quality evidence, strong recommendation)

1. Tube feeding adjustments at the discretion of the dietitian and KT team.

2. Laboratory monitoring:
   a. Basic metabolic panel daily
   b. Urine ketones every 12 hours for the first 5 days, then daily
   c. Beta-hydroxybutyrate (BHB) daily
   d. Lipase weekly while in ICU, then per KT team
   e. Fasting lipids at 1 month, then per KT team
   f. Serum blood sugar q 4 hours until tube feeds are at goal rate, then per ICU protocol
   g. Consider venous blood gases on a case-by-case basis

3. After 72 hours, consider weaning from sedating medications (if applicable).

4. No other changes to anti-seizure medications for the first 2 weeks unless there are medication side effects, convulsive or nonconvulsive seizures that impair cardiorespiratory function, or changes are deemed medically necessary by the treating or KT team.

8. Managing Side Effects

Prevention and treatment of potential side effects7,17
(UW Health GRADE Moderate quality evidence, strong recommendation)

<table>
<thead>
<tr>
<th>Potential Side Effect</th>
<th>Prevention/Treatment</th>
<th>Medications that increase risk of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation</td>
<td>Adequate hydration, bowel regimen, treat with polyethylene glycol if needed</td>
<td></td>
</tr>
<tr>
<td>Hyperlipemia</td>
<td>Stop KT if total cholesterol exceeds 400 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Acidosis</td>
<td>Adequate hydration</td>
<td>topiramate, zonisamide, acetazolamide</td>
</tr>
<tr>
<td></td>
<td>May require treatment with bicarbonate</td>
<td></td>
</tr>
<tr>
<td>Over Ketosis / Hypoglycemia</td>
<td>IV dextrose as described in blood glucose section</td>
<td></td>
</tr>
<tr>
<td>Vomiting</td>
<td>Adequate hydration, antiemetics if it occurs</td>
<td></td>
</tr>
<tr>
<td>Potential Side Effect</td>
<td>Prevention/Treatment</td>
<td>Medications that increase risk of occurrence</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Worsening Seizures</td>
<td>Stop KT if convulsive seizures occur</td>
<td></td>
</tr>
<tr>
<td>Nephrolithiasis (kidney stones)</td>
<td>Adequate hydration, potassium citrate (Polycytra K) if they occur</td>
<td>topiramate, zonisamide, acetazolamide</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>Check lipase periodically per KT team. Stop KT if elevated.</td>
<td></td>
</tr>
<tr>
<td>Weight Loss</td>
<td>Increase calories</td>
<td></td>
</tr>
<tr>
<td>Carnitine Depletion</td>
<td>Monitor carnitine and supplement as needed</td>
<td>valproic acid</td>
</tr>
<tr>
<td>Osteopenia/osteoporosis</td>
<td>Treat empirically with calcium carbonate and vitamin D supplementation</td>
<td></td>
</tr>
</tbody>
</table>

9. **Upon Transfer to General Care (still inpatient)**

*(UW Health GRADE Moderate quality evidence, strong recommendation)*

1. KT team and patient to discuss continuation of dietary therapy.

2. Swallow consult.
   a. Only approved foods and thickeners by dietitian can be used by the speech language pathologist to prevent disruption of ketosis.
   b. See note below.

3. If patient passes for PO, patient will begin KT with the modified Atkins diet (MAD) at 20 net grams of carbohydrates per day.
   a. Please order “Ketogenic” diet order and make patient “RS-2.”
   b. Nutrition technician will assist with meal planning while in the hospital.
   c. Begin modified ketogenic therapy nutrition education with patient and caregivers.

4. If patient remains NPO, continue on ketogenic formula. Discussion of PEG placement per primary team.

5. Monitoring:
   a. Check urine ketones twice per week and with any breakthrough seizures.
   b. Check weekly beta hydroxybutyrate
   c. Check weekly weights.
   d. CBC, CMP, magnesium, phosphorus, beta hydroxybutyrate, fasting lipid panel, and anti-seizure medication levels to be scheduled for one month after KT initiation
   e. Further lab testing to be determined by physician at clinic follow-up
Note that thickeners used in consistency modification for swallow evaluation as well as dysphagia diets are often starch based (6 g net carb per packet), which are not recommended for patients on KT. It is recommended to use a gum based (1g net carb per packet) or gel based (< 1g net carb per packet) thickener instead. Traditional foods used for swallow evaluation, such as graham crackers, applesauce, puddings, and yogurts will not be suitable. A swallow tray with approved foods by swallow therapist and dietitian will be available for KT patients. If patient requires an instrumental swallow evaluation, consider using Fiberoptic Endoscopic Evaluation of Swallowing (FEES) rather than a Videofluoroscopic Swallow Study (VFSS) as the barium used in a VFSS contains a significant amount of carbohydrates. If a VFSS is preferred, the swallow therapist should coordinate with the dietitian as the patient’s barium intake will need to be measured on a gram scale and additional fat should be provided to maintain the desired ketogenic ratio.

10. Upon Discharge to Rehabilitation or Home

1. If still receiving tube feeds, ensure arrangements have been made for the patient to continue receiving the ketogenic formula as it may not be pre-stocked at the rehabilitation facility or durable medical equipment (DME) provider.

2. If transitioned to oral feeds, ensure modified ketogenic therapy manual is given to patient and caregivers with teaching by dietitian.

3. Ensure that the lowest carbohydrate medications are verified as available at the rehabilitation facility and/or outpatient pharmacy prior to discharge.

4. Maintain seizure calendar.
   a. Seizure frequency
   b. Urine ketones twice per week
   c. Weekly weights
   d. Women: start and end of menses

5. Follow up in the UW Adult Epilepsy Dietary Therapy Clinic (AEDTC) 4-6 weeks post discharge.

6. Monitoring:
   a. Check urine ketones twice per week and with any breakthrough seizures.
   b. Check weekly weights.
   c. CBC, CMP, magnesium, phosphorus, beta hydroxybutyrate, fasting lipid panel, and anti-seizure medication levels in advance of 4-6 week follow-up
   d. Further lab testing to be determined by AEDTC team at follow-up

7. Maintain KT for a minimum of 3 months post-discharge. Discussion with AEDTC team at follow-up visit for weaning as appropriate.

Disclaimer
Clinical practice guidelines assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician’s judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.
Methodology

Development Process
Each guideline is reviewed and updated a minimum of every 3 years. All guidelines are developed using the guiding principles, standard processes, and styling outlined in the UW Health Clinical Practice Guideline Resource Guide. This includes expectations for workgroup composition and recruitment strategies, disclosure and management of conflict of interest for participating workgroup members, literature review techniques, evidence grading resources, required approval bodies, and suggestions for communication and implementation.

Methods Used to Collect the Evidence:
The following criteria were used by the guideline author(s) and workgroup members to conduct electronic database searches in the collection of evidence for review.

Literature Sources:
- Electronic database search (e.g., PubMed)
- Databases of systematic reviews (e.g., Cochrane Library)
- Hand-searching journals, external guidelines, and conference publications

Time Period: 2000 to 2018

Search Terms:
- Ketogenic Diet
- Status Epilepticus

Methods to Select the Evidence:
Electronic database searches (e.g., PUBMED) were conducted by the guideline author(s) and workgroup members to collect evidence for review. Expert opinion and clinical experience were also considered during discussions of the evidence.

Methods Used to Formulate the Recommendations:
The workgroup members agreed to adopt recommendations developed by external organizations and/or created recommendations internally via a consensus process using discussion of the literature and expert experience/opinion. If issues or controversies arose where consensus could not be reached, the topic was escalated appropriately per the guiding principles outlined in the UW Health Clinical Practice Guideline Resource Guide.

Methods Used to Assess the Quality of the Evidence/Strength of the Recommendations:
Recommendations developed by external organizations maintained the evidence grade assigned within the original source document and were adopted for use at UW Health.

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated by the guideline workgroup using an algorithm adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (see Figure 1).
Figure 1. GRADE Methodology adapted by UW Health

Rating Scheme for the Strength of the Evidence/Recommendations:

**GRADE Ranking of Evidence**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>We are confident that the effect in the study reflects the actual effect.</td>
</tr>
<tr>
<td>Moderate</td>
<td>We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.</td>
</tr>
<tr>
<td>Low</td>
<td>The true effect may differ significantly from the estimate.</td>
</tr>
<tr>
<td>Very Low</td>
<td>The true effect is likely to be substantially different from the estimated effect.</td>
</tr>
</tbody>
</table>

**GRADE Ratings for Recommendations for or Against Practice**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>The net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.</td>
</tr>
<tr>
<td>Weak/Conditional</td>
<td>Recommendation may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.</td>
</tr>
</tbody>
</table>

**Recognition of Potential Health Care Disparities:** None identified
Appendix A. Pharmaceutical Ingredients
For any questions regarding medications or medication ingredients, please contact the inpatient pharmacist. Note: 1 gram of carbohydrates = 4 kcal.

<table>
<thead>
<tr>
<th>Ingredients that Contain Carbohydrates</th>
<th>kcal/gm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascorbic Acid</td>
<td>4.0</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>4.0</td>
</tr>
<tr>
<td>Cornstarch</td>
<td>4.0</td>
</tr>
<tr>
<td>Dextrose</td>
<td>4.0</td>
</tr>
<tr>
<td>Erythritol</td>
<td>0.2</td>
</tr>
<tr>
<td>Fructose</td>
<td>4.0</td>
</tr>
<tr>
<td>Glucose</td>
<td>4.0</td>
</tr>
<tr>
<td>Glycerin/Glycerol</td>
<td>4.2</td>
</tr>
<tr>
<td>Hydrogenated Starch Hydrolysates (HSH)</td>
<td>3.0</td>
</tr>
<tr>
<td>Isomalt</td>
<td>2.0</td>
</tr>
<tr>
<td>Lactic Acid</td>
<td>4.0</td>
</tr>
<tr>
<td>Lactose</td>
<td>4.0</td>
</tr>
<tr>
<td>Maltitol</td>
<td>2.1</td>
</tr>
<tr>
<td>Maltodextrin</td>
<td>4.0</td>
</tr>
<tr>
<td>Mannitol</td>
<td>1.6</td>
</tr>
<tr>
<td>Pregelatinized Starch</td>
<td>4.0</td>
</tr>
<tr>
<td>Propylene Glycol</td>
<td>4.0</td>
</tr>
<tr>
<td>Sodium Starch Glycolate</td>
<td>4.0</td>
</tr>
<tr>
<td>Sorbitol</td>
<td>2.6</td>
</tr>
<tr>
<td>Sucrose</td>
<td>4.0</td>
</tr>
<tr>
<td>Sugar</td>
<td>4.0</td>
</tr>
<tr>
<td>Xylitol</td>
<td>2.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ingredients that Do Not Contain Carbohydrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
</tr>
<tr>
<td>Aspartame</td>
</tr>
<tr>
<td>Asulfamine potassium (AceK)</td>
</tr>
<tr>
<td>Cellulose</td>
</tr>
<tr>
<td>Carboxymethylcellulose</td>
</tr>
<tr>
<td>Hydroxymethylcellulose</td>
</tr>
<tr>
<td>Magnesium Stearate</td>
</tr>
<tr>
<td>Microcrystalline cellulose</td>
</tr>
<tr>
<td>Saccharine</td>
</tr>
<tr>
<td>Sucralose</td>
</tr>
<tr>
<td>Stevia</td>
</tr>
</tbody>
</table>

Information adapted from The Charlie Foundation’s “No and Low Carb Personal Care Products”