Ketogenic Dietary Therapies
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The ketogenic patient in hospital:

How to support children and adults already established on the ketogenic diet presenting with incurrent illness or for elective procedures.

ADMISSION

On admission, the patient or their carers will be able to supply:

- Information about their specific ketogenic regime.
- Contact details for their ketogenic dietitian / hospital team.
- Blood glucose and ketone testing equipment (if they use this at home).

If you are unable to obtain individual guidance, the following background basics may be of help.

MONITORING

- If the patient is unwell, it is recommended that the following biochemical indices are checked: Full blood count, renal function, liver function, ammonia, bicarbonate, lactate, beta-hydroxybutyrate, urinalysis, capillary blood gases.
- Please check weight on admission.
- Test urine for ketones each time passed.
- Check blood glucose and ketones 4 hourly if unwell or nil by mouth, otherwise please follow the individuals normal testing routine.

BLOOD GLUCOSE and BLOOD KETONE LEVELS; when to take action?

- Ketogenic therapy tends to produce a very stable blood glucose profile at the mid/ low end of the normal range and patients may not show symptoms of hypoglycaemia at 2.5-3mmol/l.

  PLEASE TAKE ACTION IF:

- **Blood glucose is 2.5mmol/l or below.** Treat with 5g Maxijul* dissolved in either 30-50ml water or sugar free squash orally or via PEG, and retest the blood glucose in 15 minutes. Repeat as required.
- **Patient is symptomatic of low blood glucose:**
  - Sweating
  - Clammy
  - Excessive Vomiting
  - Increased sleepiness or confusion
  - Fast Heart Rate
  - Fast Breathing

- **Blood ketones are 6mmol/l or above.** Treat with 5g Maxijul* dissolved in either 30-50ml water or sugar free squash orally or via PEG, and retest the blood ketones in 30 minutes. Repeat as required.

- **Patient is symptomatic of excess ketosis:**
    - Facial flushing
    - Rapid panting breath
    - Fast heart rate
    - Increased sleepiness or confusion
    - Excessive vomiting

5g carbohydrate (CHO) alternatives to 5g Maxijul if preferred:

- 50mls of Fruit Juice

- 100mls of Milk

MEDICATIONS AND IV SOLUTIONS

- Avoid carbohydrate containing medications.
  Please check with pharmacy if you are unsure of the sucrose, lactose, glycerol or corn/maize content of any new medications.
- Avoid carbohydrate containing intravenous (IV) solutions (unless managing hypoglycaemia).
  Use normal saline.
- If IV fluids are required following the treatment of hypoglycaemia or hyperketosis, use dextrose containing solutions 2.5% dex +0.45% Nacl at the appropriate rate to maintain blood glucose between 3 and 5 mmol/L and blood ketones less than 6mml/L. Once blood glucose or ketones are stable, change the IV fluids to normal saline but continue to check blood glucose and ketones 2 hourly.
- Rehydrate with water or sugar free squash if tolerated orally.
  Dioralyte (3.5g CHO per sachet) or hospital equivalent (check CHO content) may be used if electrolyte replacement is required.
- As soon as possible, return back onto ketogenic diet.
- Please liaise with the specialist dietitian during this phase.

KETOGENIC MEAL PROVISION

- A ketogenic diet (KD) is high in fat, low in carbohydrate and provides adequate protein.

- Each child or adult will have an individualized diet prescription and menu guidance. This will vary according to type of ketogenic regime and their individual nutrition requirements. See below for basic guidance *. Please ask them about their individualized KD prescription, whether they have an emergency keto-shake meal replacement recipe and the contact details for their KD dietitian on admission.

- Standard hospital menu options are often unsuitable for ketogenic diets due to the mixed ingredient nature of the items. NOTE: A ketogenic meal does not normally include any ordinary bread, potato, rice, pasta or standard breakfast cereal (although a MCT KD may include small measured amounts – see below*).

- The basics of a KD can be provided by ;
    - A cooked breakfast sent with extra butter and double cream (for drinks or to add to fruit)
      Plain cooked meat or fish with no thickened sauces or crumb coating etc.
      Vegetables (non-starchy) or salads with extra butter , cheese, and oily dressing on the side.
      Fruits (preferably berries) with double cream and sugar free jelly can be a useful addition.
    - Items can be weighed according to the individual prescription once at ward level.

- Ideally the patient will bring in scales (weigh to 1g) if required and any special prescribed products they use such as Ketocal4:1 powder or liquid, MCT oil, Calogen, Carbzero, Liquigen or Betaquik.
- Please ensure that the ingredients for the emergency keto-shake meal replacement are available in case it is required.

***KETOGENIC REGIMES; The basics**

Food type	Classical KD	MCT KD	Modified Atkins Diet or Low Glycaemic Index Treatment
Protein based foods: fish, meats, poultry, eggs, cheese	All foods weighed	All foods weighed	'Normal ' portions
Fats & Oils Butter, vegetable oils Mayonnaise, double cream, MCT oil, Calogen , Carbzero, Liquigen, Betaquik	All foods weighed	All foods weighed + measured volume of MCT oil with each meal and snack	Generous amounts included in all meals and snacks. (May use portion guidance)
Carbohydrate containing foods Vegetables (non-starchy),salads, Fruits (mainly berries), nuts, seeds, double cream, cows' milk (if used).	All foods weighed	All foods weighed	All foods weighed
Fluids Water, sugar free squash, sugar free fizzy drinks tea, coffee (use unsweetened almond or soya milk or double cream.	Unrestricted Sugar / carb free	Unrestricted Sugar / carb free	Unrestricted Sugar / carb free
Vitamin, mineral & trace element supplements	Required	Required	Required

Management guidelines for those on Ketogenic Diet undergoing General Anaesthetic

The literature on ketogenic diet and general anaesthetic is scarce, with very little consensus on management.

The most comprehensive study undertaken so far suggests that carbohydrate-free solutions are safe and blood glucose remains stable throughout surgical procedures up to 1.5 hours. The most common effect noted in procedures lasting more than 3 hours was a significant decrease in pH, requiring IV bicarbonate. Current advice therefore suggests monitoring blood pH during procedures lasting more than 3 hours and administering IV bicarbonate where necessary. (Valencia et al, 2002; Epilepsia; vol 43, issue 5; p525).

1. Contact ketogenic team in advance before the planned procedure. Please record the weight.

2. Check all urine for ketones on dipstick from admission.

3. Obtain bloods for:

FBC
Renal function
Bicarbonate
Liver function
Blood Gas
Glucose
Lactate
B-hydroxybutyrate

4. Keep nil by mouth for normal recommended time period (6 hours food/milk – Clear fluids 2 hours).

5. Use normal saline as the preferred intravenous solution and continue with carbohydrate-free solution throughout anaesthetic (use either 0.9% sodium chloride solution or Hartman's solution).

6. If anaesthetic is likely to be greater than 3 hours duration, monitor blood gas (pH and bicarbonate), B-hydroxybutyrate and glucose and treat any hypoglycaemia or hyperketosis by giving an IV bolus of 10% dextrose and changing to IV dextrose 2.5%/0.45% saline solution. IV bicarbonate can be given if blood pH is <7.2.

7. Continue IV normal saline until oral fluids tolerated.

8. Re-introduce normal (ketogenic) diet as soon as possible.

This information has been approved by members of the Matthew's Friends Medical Board.

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