20(!) QUESTIONS FOR DOCTORS CARING FOR CHILDREN WITH DIABETES

Children with diabetes spend a long time in hospital. They require an enormous amount of education and support and our aim should be for them to live a normal life.

The following tips, tricks and traps are useful in the ongoing ambulatory management of children with diabetes. The management of Ketoacidosis is covered in the “DKA” guideline

1. What should the blood glucose levels run at?
   - The ideal is for the blood glucose level to be kept between 4 – 6mmol/l.
     - At this level there will be no glucose or ketones in the urine. This minimises long term complications but there is a high risk of hypoglycaemic episodes.
     - If you are aiming for this level you must be sure the family are comfortable with the management of hypoglycaemia and that they have a glucagon kit.
   - In most of our patients from the rural areas, it is reasonably safe if the blood glucose level runs between 4 – 10mmol/l. Aim for 4-8mmol/l before meals and 6-10mmol/l 2 hours after meals. Tighter control thereafter.
     - At this blood glucose level there will always be some glucose in the urine but usually no ketones.
     - Tighter control can gradually be achieved as the child grows older and learns more about diabetes.
   - If the child is from a very disadvantaged family a blood glucose level of 10-15 may be unavoidable.
     - This will keep the child alive but will not prevent rapid progression of diabetic complications. There will be lots of glucose in the urine with fairly frequent ketones.
     - The child will also have many admissions for “poor control”. In this situation one should consider putting the child in foster care or even hospitalising for long periods of time while sorting out the home circumstances.

2. How should desired Blood Glucose levels be achieved?
   - **Insulin Regimen**
     - The usual starting dose of insulin is 0.6 u/kg, as illustrated by the example below: (maximum dose generally regarded as between 1.2 to 1.5 units/kg, but may need to use whatever dose is required to control sugars. If requiring >1.2 units/kg refer to Grey’s or IALCH Endocrine Clinic.)
     - **2/3 of the total dose in the morning**
       - This is given as Actrapid (%) and Protophane (%) 1/2 HOUR BEFORE BREAKFAST.
     - **1/3 of the total dose in the evening**
       - This is given as as Actrapid (%) half an hour before supper and Protophane (%) before going to bed at night with a snack at 21h00 - 22h00.
       - This is annotated as follows for a 30kg child:

       ![Insulin Dose Diagram]

       If the family cannot cope with a three injection/day regimen then Actraphane 2/3 before breakfast and 1/3 before supper can be used. This will be at the expense of good control and there will often be a problem with early morning hypoglycaemic episodes. This regimen for a 30 kg child is annotated as follows:

       ![Actraphane Dose Diagram]

3. What syringes should be used?
   - 50 unit insulin syringes should be used. The 100 unit syringes are inaccurate for the small amount of insulin that most children need. Each syringe can be reused for a few days until the needle is blunt.
4. **Is the Injection technique and site important?**
   - It is very important and needs to be carefully taught and checked at intervals.
     - The skin is pinched and the needle is inserted at right angles to the skin.
     - The plunger is depressed and the child should wait a few seconds before withdrawing the syringe. (Otherwise the insulin leaks out).
     - Most children use their thighs - it is very important that they rotate the injection sight otherwise they will develop lipodystrophy which is unsightly and affects insulin absorption negatively.
     - Buttocks, upper arms and stomachs can also be used

5. **What should be known about insulin?**
   - If the child does not have a fridge then the insulin must be replaced monthly even if all has not been used
   - All insulins should be mixed gently by rolling the vial in the palm of the hand before using. Do not shake vigorously
   - Patients need to be taught a special technique for mixing insulin if they are on the Actrapid/Protophane regimen
   - Never use Actrapid if it has gone cloudy
   - Do not use insulin if it has passed its expiry date
   - Insulins are not interchangeable e.g. you cannot substitute Monotard for Actraphane

6. **What should be known about home monitoring?**
   - Home monitoring is essential. All children or their carers should be issued with a home-monitoring diary and be taught how to use it. They must bring the diary to every visit.
   - Children should check their Blood Glucose 2 to 3 times each day. It should be done every day before breakfast and at before supper. It can also be checked before lunch and before going to bed on alternate days. It should be done more frequently if the child is unwell.
   - Ideally the child should have a glucometer but as they are expensive this is not always possible. They should then use the colour coded Glucostix 4. If they cannot afford an autolet for pricking the fingers then they will need to be supplied with lancets which are very much more painful.
   - The urine should be tested twice a day using ketodiastix looking for glucose and ketones. This should also be recorded in the diary. If there are ketones consistently the child needs to come to hospital to find the cause. The urine should be tested in the morning and then at another time during that day. Ketones in the morning only should make one suspicious of early morning hypoglycaemic episodes. The urine should also be checked if the blood glucose is above 15

7. **How should insulin doses be adjusted?**
   - Do not act on a single raised blood glucose, rather look for a trend over a few days. Depending on when the raised (or low) blood glucose level occurs adjust the insulin dose that should have covered that period of the day by 1-2 units.
   - Make only one adjustment at a time.
   - When children are starting or experiencing difficulties in controlling blood glucose they need to be seen frequently (at least every week if not every few days). It is pointless to keep them in hospital to try to find the right insulin dose as their blood glucose levels invariably run high due to the inactivity and diet. One wants to get them on the optimal insulin doses for their home diet and level of activity. Aim to get their blood sugars about 12mmol/l and free of urinary ketones while in hospital, then fine tune as an outpatient.

8. **What to do if the blood glucose level is more than 15?**
   - Give another 2 units of Actrapid or Actraphane depending on regimen together with a snack.
   - Test urine for ketones. If present and persist after a few hours, medical attention should be sought.

9. **What to do if the blood glucose level is less than 4?**
   - Decrease that insulin dose by one third and eat the meal/snack as usual

10. **What do you need to tell a child with diabetes and then monitor for understanding at follow up visits?**
    - Explain what diabetes is, why insulin injections are needed and that they will be needed lifelong
    - Teach how much insulin they need, when they must give it and how to give it. Mixing insulins requires a special technique that must be taught
    - Teach how to test blood for glucose, urine for glucose AND ketones, how to record results in the diary, and to bring the diary to each visit
    - Advise what blood glucose to aim for
    - Advise when to seek medical advice
    - Teach how to deal with hypoglycaemia and hyperglycaemia
    - Explain how to deal with “sick days”

11. **How should hypoglycaemia be dealt with?**
    - The child will recognise “hypo’s” because they feel shaky, headachy and dizzy. They need to learn to recognise this early and to act before going into a coma. They should always carry glucose containing sweets with them. Once they have recovered they should eat a snack.
    - Their family should also know how to recognise hypoglycaemia:- the child usually goes pale, sweaty and his
behaviour will change. If a child is uncooperative or comatose because of a hypo the caregiver should smear some honey or jam on the inside of the cheek and follow this with a snack when the child has recovered.

- If the child does not respond or is fitting he should be given a glucagon injection (all diabetics must be given glucagon rescue kit to keep at home), and rushed to hospital.

12. How to deal with hyperglycaemia?

- Hyperglycaemia is less dangerous than hypoglycaemia and develops over a longer time. This is recognised because the child will have polyuria/polydipsia and the blood glucose levels will be consistently above 15. There will be a lot of glucose in the urine and there may be ketones
- At home: give an additional rapid acting insulin (Actrapid, Humalog) at 0.1 units/kg, test urine for ketones and if present another 0.1 units/kg. (In patients with good understanding of the disease, this could be continued hourly at home until GMs < 15 and urine ketones are cleared, with telephonic support from medical team).
- The child should then come to hospital to see the doctor and have the insulin dosage adjusted

13. What should a child with diabetes eat?

- A "diabetic diet" for a child is not very difficult as they are growing and so do not have restricted calories or protein. They should avoid fatty foods and simple sugars. They can have them as a treat once a week (e.g. at a party) and then either have an extra 2 units of insulin or accept a transiently high blood glucose.
- They should eat a healthy diet with high fibre (no white bread), low fat, normal protein and complex carbohydrate. The child should eat 6 times each day.
- S/He should eat 4-5/servings of fruit each day.
- It is useful to supply the child and family with information booklets and stories to help them understand as much as possible about their illness.
- The child will need extra food if s/he exercises a lot.

**Example diet:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>Cereal with sweetener, toast and milk</td>
<td></td>
</tr>
<tr>
<td>Midmorning snack</td>
<td>2 slices brown bread + fruit</td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td>Meat + vegetables + rice</td>
<td></td>
</tr>
<tr>
<td>Mid afternoon snack</td>
<td>Fruit and brown bread</td>
<td></td>
</tr>
<tr>
<td>Supper</td>
<td>Whatever the family eats (excluding sugar)</td>
<td></td>
</tr>
<tr>
<td>Evening snack</td>
<td>Brown bread and peanut butter + milk</td>
<td></td>
</tr>
</tbody>
</table>

14. What should the doctor check at each visit?

- Polyuria/polydipsia and enuresis suggest insufficient insulin
- Look at diary and adjust insulin if necessary
- Ask after hypoglycaemic episodes and check the child and family know how to handle them
- Injection sites for lipodystrophy
- Discuss diet

15. What long term follow up is necessary?

- Check BP from time to time
- Yearly referral for eye examination
- 5 years post diagnosis (or earlier if control is poor) check urine for microalbuminuria: take 2-3 early morning urine samples and calculate the albumin/creatinine ratio. If it is elevated then start an ace-inhibitor as this delays progression to diabetic nephropathy
- Hb1c is not very useful in our patients as it will be elevated in patients whose blood glucose is being controlled between 5 and 10. It will only be useful in a patient in whom the blood glucose is ostensibly tightly controlled but appears poorly controlled to the doctor. This may occur when a child/family are non compliant but say they are compliant. The Hb1c will give a guide to the blood glucose control in the last 2 to 3 months. The acceptable range is 5 - 8

16. Has the child got a Medic Alert?

- All Children living with Diabetes should wear Medic Alert bracelets or necklaces

17. When to admit?

- It is not always easy to decide when to admit a child with diabetes. Obviously a child with DKA or hypoglycaemic coma needs admission.
- It is wise to admit during intercurrent infections if the child is unwell. Blood glucose control is more difficult during illness particularly if the child is unable to eat or is vomiting. Insulin should be continued and intake should be maintained. If the family can cope at home they must check the blood and urine more frequently and return if they are not coping. If there are ketones in the urine twice over 3 hours or if the blood sugar is above 15 for 12 hours or more, then medical attention should be sought
- A child with ketones in the urine does not necessarily need admission. If they are well adjust the insulin dose and review a few days later
18. What are common causes of high insulin requirements?
- Psychological - e.g. an adolescent not actually injecting the insulin
- Unrecognised infection e.g. TB, dental abscess, UTI, lobar pneumonia
- Puberty
- Insulin resistance
- Hypo- or hyperthyroidism
- Out of date insulin
- Lipodystrophy

19. What should the child with diabetes do with respect to exercise?
- Children with diabetes should be encouraged to live a normal life and this includes taking part in sports
- They should have an extra snack or a simple sugar before strenuous exercise and be on the lookout for “hypo’s”
- Doctor should be doing an exercise prescription: dose, duration, frequency and intensity of exercise. Current recommendation is mild – moderate intensity exercise, 3-5x/week for 20-30 minutes. Once fitness improves this can be increased in consultation
- Ideally, sugars must be checked before, during and after exercise initially, to determine the effect of the exercise on sugars and insulin requirements. The major worry is “hypo’s” – if feeling unwell or weak during exercise – sugar must be checked. With time – testing can be tailored to individual patients during exercise
- Risk for hypo’s is higher with strenuous exercise, after insulin or if meals/snacks are omitted or forgotten
- Exercise with a buddy or family member that can assist if problems arise

20. Who to phone for help?
- Dr Barnesh Dhada via Grey’s Hospital Switchboard: 033 897 3000. In my office: 033 897 3287
- Grey’s Hospital POPD BETWEEN 08H00 – 16H00 (ask for Paediatric Registrar): 033 897 3185
- Grey’s Hospital WARD E2 after hours: 033 897 3014 (ask for the paediatric doctor on call)