

# Sick day management of diabetes

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When a person with diabetes becomes sick, not only does the sickness need to be dealt with but also the potential diabetes-related issues.

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**W**hen people without diabetes get sick, such as with a cold or influenza, management is usually pretty straightforward: go to bed, keep up the fluids and see what happens. They will get better (fine), stay the same (okay) or get worse (not so good). Most will be fine or okay and those who are 'not so good' can contact their GP for more advice and clinical review. When a person has diabetes, not only does the sickness need to be dealt with but also the diabetes needs managing so that it does not become a problem in its own right.

This article reviews the diabetes-related issues associated with sick days and suggests management plans to deal with them. Both type 1 and type 2 diabetes are covered in the discussions of a sick patient with diabetes.

## THE CASE

*'John is sick with vomiting and diarrhoea. What shall I do about his insulin? He is nauseous and not eating, but his blood glucose level is 17.6.'*

Helen, John's wife.

## WHAT ARE THE DIABETES-RELATED ISSUES?

Two disturbances secondary to diabetes of concern for John are glycaemia and fluid and electrolyte imbalance.<sup>1</sup> Factors influencing these disturbances are discussed below and summarised in the box on page 65.

## Type 1 versus type 2 diabetes

In general, sickness is of far greater concern in patients with type 1 diabetes than in those with type 2 diabetes. Blood glucose levels (BGLs) and fluid and electrolyte

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## FACTORS INFLUENCING DIABETES-RELATED SICK DAY ISSUES

### Type 1 versus type 2 diabetes

- Type 1 diabetes is of more concern than type 2 diabetes

### Systemic unwellness versus gastrointestinal upset

- Vomiting and/or diarrhoea sickness in the absence of systemic unwellness is associated with hypoglycaemia, particularly when combined with no carbohydrate intake
- Systemic sickness (e.g. fever, aches and pain) is associated with hyperglycaemia

### Gastrointestinal and/or renal losses of fluids and electrolytes versus oral intake

- Fluid and electrolyte loss with limited or no immediate oral replacement can lead to dehydration and electrolyte imbalance
- Renal losses may be more important than gastrointestinal losses, especially in younger patients and patients with type 1 diabetes

### Availability of competent, confident support

- Available and competent family members or other carers can lessen need for home visits by GPs or referral to hospital emergency departments

levels can be much more seriously and more rapidly disturbed in patients with type 1 diabetes than in those with type 2.

John is using insulin and could have either type 1 or type 2 diabetes. If it is not already known which type he has and he cannot be asked directly, asking his wife how long after diagnosis he started insulin therapy should reveal his type (see the box on this page).

## DOES A PATIENT HAVE TYPE 1 OR TYPE 2 DIABETES?

Many people and health professionals assume a patient has type 1 diabetes rather than type 2 simply because they are using insulin. The patient may even assume this.

Type 1 and type 2 diabetes cannot be differentiated between by whether insulin is being used, nor by the current age of the patient, the age of diagnosis of diabetes or how long insulin has been used. Most people with type 1 diabetes need insulin within one year of diagnosis, whereas those with type 2 diabetes usually need insulin after several years.

The question to ask a family member or other carer is therefore:

‘How long after diagnosis did the patient start insulin?’

### Systemic unwellness versus gastrointestinal upset

If John has a short-term ‘food poisoning’ type of illness (e.g. related to staphylococcal toxin in food), his vomiting and diarrhoea may be very distressing but will not be associated with systemic unwellness (with fever, aches and pains, and so on). His vomiting may be very active physically and if combined with no carbohydrate intake may make him prone to hypoglycaemia, prompting a reduction in hypoglycaemic medication. In contrast to a gastrointestinal (GI) illness, systemic unwellness is associated with hyperglycaemia, prompting an increase in hypoglycaemic medication (see the flowchart on page 67).

When reducing hypoglycaemic medication in patients with type 1 diabetes, both the basal and bolus insulin doses may be reduced. Although the bolus insulin may be ceased completely, it is very important to continue the basal insulin, albeit at a much lower dose (reduced by up to 50%).

## Gastrointestinal and renal losses versus oral intake

John’s vomiting and diarrhoea and any osmotic diuresis secondary to hyperglycaemia are associated with losses of fluid and electrolytes. These losses in the face of limited or no oral replacement can lead to dehydration and electrolyte disturbances, such as hypokalaemia (see the flowchart). These problems are more likely if John is taking a diuretic, which reduces the effectiveness of physiological compensatory responses.

The vomiting and diarrhoea are obvious but may not be the most important disturbances. Renal losses of fluid and electrolytes can be considerable, especially in younger people (who generally have a lower renal threshold for glycosuria) and in people with type 1 diabetes (in whom ketonuria induces sodium and potassium loss).

## Availability of competent, confident support

John has his wife, Helen, to monitor whether he is getting better, staying the same or getting worse. She can also help him to deal with the sickness.

If Helen seems competent to provide the needed support and is confident in her capacity to monitor John’s progress and contact his GP if he gets worse, the GP may decide to provide advice over the phone rather than urgently reviewing John at home or referring him to the local hospital’s emergency department.

## WHAT ARE THE APPROPRIATE RESPONSES TO THESE ISSUES?

Responses fall into the four broad categories discussed below and summarised in the box on page 68.<sup>1,2</sup>

### Medication

Usually sick days are associated with systemic unwellness and more hypoglycaemic medication is needed because the physiological changes associated with this type of sickness increase insulin

resistance. However, as noted earlier, if a patient is not systemically unwell but is very actively vomiting and/or straining at stool (e.g. has diarrhoea) then, if there is no carbohydrate intake, a reduction in hypoglycaemic medication may be wise to lessen the risk of hypoglycaemia.

#### *If John has type 1 diabetes*

John would be much less likely to be using oral hypoglycaemic agents (OHAs) if he had type 1 diabetes than if he had type 2 diabetes. However, if he were using metformin, exenatide or acarbose, it might be wise to temporarily discontinue them because these medications may exacerbate his GI upset.

As John has type 1 diabetes, he probably uses mealtime bolus insulin as well as basal insulin, either separately or as a premixed preparation. Although he is not eating, he has hyperglycaemia (BGL of 17.6 mmol/L) because of systemic disturbance and should be given extra quick- or very quick-acting insulin. If he is using one of the traditional or analogue bolus insulins (neutral insulin [human] and aspart, glulisine and lispro, respectively), it is relatively easy to adjust the dose. If he is using a premixed insulin, adjustment is more difficult because both basal and bolus insulin are being adjusted at the same time. The quick-acting bolus component of the premix preparation will reduce glycaemia relatively quickly but the long-acting basal component will have little hypoglycaemic effect in the short term but may cause hypoglycaemia later, especially if several successive doses of premixed insulin are used to control hyperglycaemia. His dose of basal insulin (intermediate-acting isophane insulin [human] or one of the long-acting basal analogues detemir and glargine) should not need adjustment.

#### *If John has type 2 diabetes*

John may be using OHAs or insulin (basal, basal plus bolus, or premixed)

alone or in various combinations if he has type 2 diabetes.

The same applies for patients with type 2 diabetes as for those with type 1

diabetes regarding reducing the doses of or temporarily discontinuing metformin, exenatide or acarbose if there is GI disturbance with much vomiting

### APPROACHES TO MANAGING SICK DAY DISTURBANCES SECONDARY TO DIABETES

#### Glycaemic disturbances

Gastrointestinal upset;  
no carbohydrate intake

Hypoglycaemia

Reduce hypoglycaemic  
medication

Systemic unwellness  
(e.g. fever, aches, pains)

Hyperglycaemia

Increase hypoglycaemic  
medication

#### Fluid and electrolyte disturbances

Gastrointestinal loss of  
fluids and electrolytes –  
due to vomiting and/or  
diarrhoea

Renal loss of fluids and  
electrolytes – due to  
osmotic diuresis secondary  
to hyperglycaemia

If limited or no oral fluid and electrolyte intake

Dehydration, electrolyte disturbances  
(e.g. hypokalaemia)

Oral replacement – with fluid  
and electrolyte correction  
solution or water +/- diet cordial

**RESPONSES TO DIABETES-RELATED SICK DAY ISSUES****Medication**

- For systemic unwellness, increase hypoglycaemic medication
- For vomiting and/or diarrhoea in the absence of systemic unwellness, particularly when combined with no carbohydrate intake:
  - reduce hypoglycaemic medication
  - consider stopping metformin, exenatide and acarbose because they may aggravate or prolong the GI upset
  - consider stopping any long-acting sulfonylurea because doing so may simplify glycaemic control using bolus insulin

**Fluids**

- Use an oral fluid and electrolyte correction solution (or, if not available, water with or without diet cordial) to replace the GI and/or renal losses
- For patients with type 1 diabetes, give glucose-containing drinks if BGL is below 15 mmol/L and sugar-free drinks if BGL is 15 mmol/L or higher

**Monitoring**

- Check every four to six hours:
  - overall progress
  - BGL: give extra bolus insulin if BGL exceeds 15 mmol/L
  - ketone level in type 1 diabetes
  - hydration, by assessing intake and losses and/or bodyweight

**Referral**

- Refer if there are any of:
  - concern about ongoing, competent, confident support
  - worsening of the underlying sickness
  - inability to tolerate oral intake of food or fluid in the presence of significant GI and/or renal losses
  - hyperglycaemia (BGL above 15 mmol/L) if bolus insulin is not available
  - hyperglycaemia not responding to four-hourly bolus insulin, worsening or associated with significant ketonuria/aemia

and/or diarrhoea. Stopping a sulfonylurea, particularly one that is long-acting (glimepiride, glipizide or a modified-release preparation of gliclazide), will simplify any short- and medium-term adjustment of bolus insulin doses. A patient who is not eating will, however, not need quick- or very quick-acting insulin unless he or she becomes hyperglycaemic. In the event, vomiting may mean no oral medication can be taken.

As for patients with type 1 diabetes,

the bolus insulin is the simplest insulin to adjust in response to hyperglycaemia. Adjusting premixed insulin is more difficult, and adjusting basal insulin is even more difficult. Any hypoglycaemic effect from the basal insulin will take several hours with the intermediate-acting isophane insulin (human) or many hours with the long-acting basal analogue glargine.

Any inadvertent excess of basal insulin may cause hypoglycaemia many hours after the insulin adjustment. This may be

difficult for Helen to deal with if John is still nauseous and vomiting.

If John is not using bolus insulin, there should be a lower threshold for referral for outside help.

**Fluids**

An oral fluid and electrolyte correction solution (possibly made into ice blocks) is recommended to replace the losses of fluids and electrolytes. If the correction solution is not available, water with or without diet cordial could be used (but not soft drink, fruit juice or sugary cordial). In patients with type 1 diabetes, glucose-containing drinks (or sucrose-containing drinks if acarbose is not being used) should be given if BGL is below 15 mmol/L and sugar-free drinks if BGL is 15 mmol/L or higher.

John should be encouraged to take frequent small drinks of a correction solution or a suitable alternative, totalling 5 to 10 mL/kg/hr plus GI losses (measured or estimated). If he later becomes hypoglycaemic because of the physical activity involved in his vomiting and/or straining, Helen could give him a high glycaemic index carbohydrate food or fluid (ideally glucose). If John cannot tolerate oral fluids, there should be a lower threshold for referral.

**Monitoring progress**

At the start, we identified that John could get better (fine), stay the same (okay) or get worse (not so good). If Helen and John think things are fine or okay, there is no obvious need for concern. However, some diabetes-related issues – namely, increasing pyrexia, glycaemia, dehydration and ketoacidosis – may not initially be obvious. In addition, ketoacidosis itself may worsen or precipitate nausea or vomiting. Fortunately, these issues can be monitored and problems can then be detected and responded to early at home rather than later in hospital.

Helen should check John's overall progress, BGL, ketone level (if he has type



1 diabetes) and hydration regularly (every four to six hours), recording the results and also her responses if his sickness is severe or worsening. Further information is given below.

#### Overall progress

Increasing pyrexia, confusion, weakness or sleepiness may indicate progression of the underlying illness or worsening of glycaemia, dehydration or ketonaemia.

#### Glycaemia

Extra quick- or very quick-acting insulin should be given if BGL exceeds 15 mmol/L (10% of the basal dose if BGL is in the range 15 to 20 mmol/L and 20% if BGL is greater than 20 mmol/L). Further doses should be given at four-hourly intervals.

#### Ketonaemia/uria

If John has type 1 diabetes and the equipment is available, urine or blood should be tested for ketones if his BGL exceeds 15 mmol/L.

#### Hydration

John's fluid intake and losses should be monitored and his fluid intake maintained at 5 to 10 mL/kg/hr plus losses (which can be measured or estimated). Monitoring a person's weight gives a good idea of overall fluid status as long as accurate scales are available and weighing the person is practical.

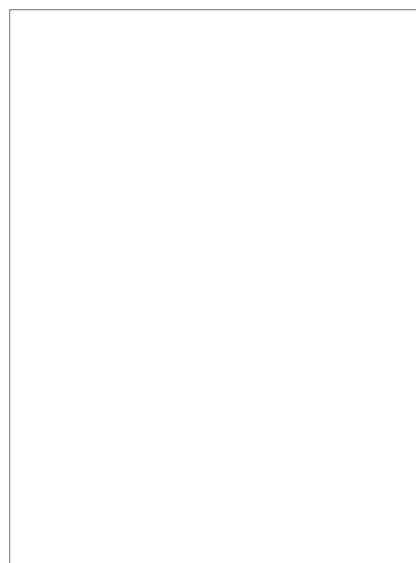
#### Referral

Some people with diabetes who have a systemic sickness or a GI disturbance may become too sick to be managed at home. 'Red flags' that should trigger referral of such patients include the following:

- concern by the GP, the person or carer that ongoing, competent, confident support is not available
- worsening of the underlying sickness, particularly if associated with confusion, sleepiness or increasing pyrexia
- inability to tolerate oral intake of

food or fluid, despite the need or likely need for replacement of GI losses, or for high glycaemic index food or fluids

- hyperglycaemia (BGL above 15 mmol/L and certainly above 20 mmol/L) if quick- or very-quick acting insulin is not available



- hyperglycaemia that is not responding to four-hourly bolus insulin, is worsening or is associated with significant ketonuria/aemia.

#### SUMMARY

In people with diabetes who become sick, potential diabetes-related issues need to be managed so that they do not become problems in their own right. Potential issues that should be assessed include the type of diabetes, type of sickness (systemic unwellness or a GI disturbance with active vomiting and/or straining in the absence of systemic unwellness), GI and renal losses versus oral intake, and ongoing availability of competent and confident support. Appropriate responses depend on the particular diabetes-related issue but include medication adjustment, fluid therapy and four to six-hourly monitoring of overall clinical status, glycaemia, ketonuria/aemia

(in type 1 diabetes) and fluid status.

Referral to an emergency department is prompted by concern about ongoing support for the patient, the patient's inability to tolerate oral intake in the presence of significant fluid loss and worsening of the overall clinical state. Patients with hyperglycaemia should be referred if bolus insulin is not available or the hyperglycaemia is not responding to four-hourly corrective doses of bolus insulin, is worsening or is associated with significant ketonuria/aemia. **MT**

#### REFERENCES

1. Harris P, Mann L, Phillips PJ, Bolger-Harris H, Webster C. Diabetes management in general practice. Guidelines for type 2 diabetes. 17th ed. 2011/12. Canberra: Diabetes Australia; 2010. Available online at: [www.racgp.org.au/guidelines](http://www.racgp.org.au/guidelines) (accessed August 2011).
2. Australian Diabetes Educators Association (ADEA). Guidelines for sick day management for people with diabetes. Canberra: ADEA; 2009. Available online at: [www.adea.com.au/asset/view\\_document/979316048](http://www.adea.com.au/asset/view_document/979316048) (accessed August 2011).

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