

Prevention of Diabetic Ketoacidosis (DKA) in Insulin Pump Therapy ADULT

DKA is a Serious Complication of Diabetes

DKA happens when your body does not have enough insulin and your blood glucose (sugar) rises quickly. If your body cannot use glucose for energy, it uses fat for energy instead. When this happens, ketones start to build up in your blood. Higher levels of ketones in your blood can make the blood acidic, this can make you very sick and can result in coma or death.

What are the Symptoms of DKA?

- “Fruity” smelling or tasting breath
- Nausea, vomiting
- Fast heartbeat
- Pain in your abdomen
- Trouble breathing
- Weakness

What can cause DKA?

When you use an insulin pump you are at a higher risk for DKA because you are not using long-acting insulin. Ketones and possibly DKA can develop quickly (2 to 4 hours) if your insulin delivery is interrupted or for any of these reasons:

- Infusion site failure
- Illness (cold, flu, nausea, vomiting, or diarrhea)
- Missed insulin boluses
- Stress
- Insulin pump not working
- Pregnancy
- Infection, injury, or surgery
- Incorrectly stored or expired insulin

Risk of DKA during Pregnancy

If you are pregnant, DKA can harm both mother and baby, and may cause fetal death. Later in pregnancy you are less sensitive to insulin and your insulin doses will increase. You may need to change your infusion site more often, sometimes daily, to help prevent DKA.

How can I prevent DKA on an insulin pump?

Below are daily care tasks to prevent DKA.

- Check for ketones (fingertip blood test or urine test) if you have:
 - Glucose values over 14.0 mmol/L
 - Symptoms of DKA (nausea, vomiting, abdominal pain, lightheadedness, fruity smelling breath, or shortness of breath), **even if your glucose level is in target, especially if you are on SGLT2 inhibitor.**
 - Signs of dehydration (dry mouth, dry tongue, cracked lips, sunken eyes, drowsiness, dizziness, feeling faint, or a fast, pounding heartbeat).
- Check your glucose often throughout the day and always before bed. Consider using continuous glucose monitor high alerts.
- Inspect pump, infusion site, insulin cartridge, and tubing connections before bed or anytime your glucose is unexpectedly above target.
- Change infusion sets every 2-3 days (up to 7 days for extended wear sets) or sooner, if needed.
- Rotate your infusion sites to prevent lipohypertrophy (fatty tissue lumps under the skin).
- Prepare in Advance:
 - Keep a pump safety kit with **fresh** insulin (no more than 1 month at room temperature), syringe or insulin pen, ketone testing supplies, glucose tablets, fresh batteries or power source, a blood glucose meter with test strips and updated list of pump settings.

- Have your diabetes clinic's guidelines for managing sick days. This may include increasing the size of boluses or using temporary increased basal rates.
- Have your diabetes clinic's guidelines for how to replace insulin if your pump fails.
- Have your diabetes clinic's phone number if you need help.
- Have the 24-hour number of your pump company.

How do I correct high glucose and ketones on a pump?

Steps to Correct High Glucose & Ketones and No Vomiting

The following are times that you can usually manage at home, without emergency care.

Blood ketones 0.5 mmol/L or less OR Urine ketones negative/trace (below 5 mg/dL)	Blood ketones are 0.6 mmol/L to 2.9 mmol/L OR Urine ketones above trace (above 5 mg/dL up to 79 mg/dL)
<ol style="list-style-type: none"> 1. Take usual correction bolus with pump. 2. Drink: 125 to 250 mL (1/2 to 1 cup) sugar free fluids every hour 3. Troubleshoot* 4. Recheck blood glucose in 2 hours. 5. If glucose is below 14.0 mmol/L, give bolus corrections with pump every 2 to 4 hours until glucose is in target. 6. If glucose is above 14.0 mmol/L: <ul style="list-style-type: none"> • Check ketones again if above trace use other side of table. If negative or trace follow below, • Take your usual correction bolus again using pen or syringe. Put pump in manual mode, if not already. • Change infusion set, reservoir, tubing, infusion site and insulin. • Troubleshoot* • Recheck blood glucose in 2 hours 	<ol style="list-style-type: none"> 1. Put pump in manual mode. 2. Take 1.5X correction by pen or syringe using these steps: <ul style="list-style-type: none"> • Take your current glucose reading and subtract target glucose reading, • Divide this number by your insulin sensitivity factor or correction factor, • Multiply by 1.5[^] • The answer is the units of insulin to give. 3. Change infusion set, reservoir, tubing, site, and insulin. 4. Drink 125 to 250 mL (1/2 to 1 cup) sugar free fluids every hour 5. Troubleshoot* 6. Recheck blood glucose in 2 hours. If blood glucose is: <ul style="list-style-type: none"> • 14.0 mmol/L or less, give bolus corrections with pump every 2 to 4 hours until glucose is in target. • More than 14.0 mmol/L, retest ketones and repeat steps 1 to 5. 7. Stay in manual mode for at least 4 hours after the last injection by syringe or pen. Do not use an Automated Insulin Delivery feature (loop) during that time.
<p>^If blood ketones are 0.6 mmol/L or more, or urine ketones over trace, give a correction of insulin that is 50% more than what the bolus calculator recommends. Use an insulin pen or syringe. Calculate 1.5 times correction dose like this:</p> $1.5 \times \frac{(\text{Current Blood Glucose} - \text{Target Blood Glucose})}{(\text{Insulin Sensitivity Factor or Correction Factor})} = \text{number of units of insulin}$	
<p>If high blood glucose and ketones continue or get worse AFTER 2 corrections and/or symptoms of DKA start or do not improve, go to the emergency department.</p>	

***Troubleshoot:**

- Verify sensor glucose readings with a fingertip blood glucose meter.
- Check the infusion set is attached, not leaking & has been changed according to clinic/manufacturer recommendations. Check site is not irritated or damp (e.g., tunneling).
- Check tubing for blood, leaks, or large bubbles. Check that you primed the tubing.
- Check bolus history, basal rate settings and temporary basal rates, to evaluate normal pump functioning.
- Consider using a new vial or batch of insulin and change the cartridge or pod.

When should I go to the emergency department?

Go to the emergency department if you have **any** of these:

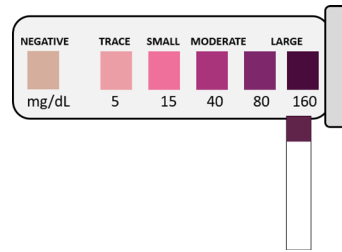
- Blood ketones 3 mmol/L or more (or urine ketones 80 mg/dL or 3+ or more)
- Vomiting and unable to keep fluids down AND testing is positive for ketones.
- Signs or symptoms of DKA or dehydration
- Pump failure AND a replacement pump is more 2 hours away AND you don't know how to replace insulin manually AND you can't reach your diabetes team.

Ketones

Blood Ketone Values



Urine Ketone Values



Information and Notes:

Diabetes Centre Phone Number: _____

Insulin Pump Company Number: _____

Notes: