UMass Memorial Health

UMass Chan MEDICAL SCHOOL

Diabetes Center of Excellence

INSULIN PUMP THERAPY

NEW PATIENTS: **855-UMASS-MD** (855-862-7763) | EXISTING PATIENTS: **508-334-3206**

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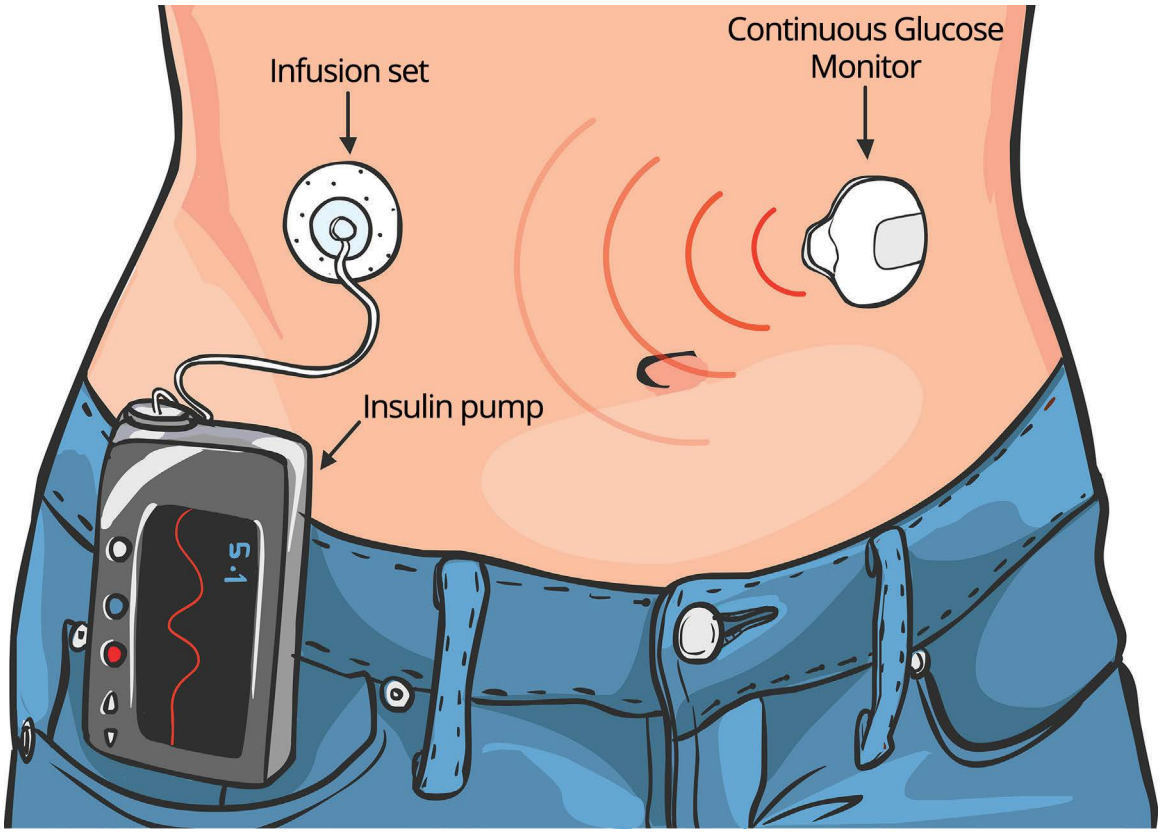
INSULIN PUMP THERAPY

Congratulations on your decision to manage diabetes using an insulin pump. Starting to wear an insulin pump is an exciting time. It's important to begin with realistic expectations about what an insulin pump can and cannot do. A pump *can* improve blood glucose control, but you must continue to check glucose levels using a continuous glucose monitor (CGM) or glucose meter.

You must still give insulin based on carbohydrate intake and glucose level. It's *unrealistic* to expect to not give a bolus for food or high glucose levels, or to not have to monitor glucose levels and make decisions based upon them.

While the insulin pump continuously delivers insulin, *it's not a cure for diabetes*. The goal is to better manage your blood glucose levels while avoiding wide fluctuations and to prevent severe hypoglycemia (low blood glucose). Don't be discouraged if your glucose levels don't achieve goal immediately. It may take some time to work with your diabetes care team to determine the pump settings that work best for you.



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REVIEWING PUMP THEORY CONCEPTS

RAPID-ACTING INSULIN

Rapid-acting insulin is most widely used in insulin pumps. Generally, these insulins begin working within 10 to 15 minutes - work the hardest at 90 minutes - and are gone between three and five hours.

BASAL INSULIN DELIVERY

Basal insulin delivery is the continuous delivery of background insulin that replaces long-acting insulin. This keeps your glucose levels steady between meals, and glucose should remain within target range when not eating. The pump can be programmed to deliver different amounts of insulin at various times to mimic a healthy pancreas. Basal rates are recorded as units per hour, in other words, how much insulin is delivered during an hour. It's not meant to cover the rise in glucose due to food intake or correct high glucose levels.

TEMPORARY BASAL DELIVERY

Temporary basal delivery is a short-term adjustment made for nonpermanent changes in your daily routine. Glucose levels often drop during and after exercise. A temporary reduction in your basal rate while exercising can help prevent hypoglycemia. Illness, stress and certain medications can cause a rise in the glucose levels. A temporary increase in your basal rate can help prevent hyperglycemia (high blood glucose) during these times.

FOOD BOLUS

Food bolus is the amount of insulin needed to cover the rise in glucose while eating. Your insulin to carbohydrate ratio is programmed into the pump based upon time of day. Whenever eating a meal or snack, you must enter the amount of carbohydrates, and the pump will calculate the proper dose to be administered.

CORRECTION BOLUS

Correction bolus is the amount of insulin required to lower or "correct" a high glucose reading. It can be given with the food bolus or alone. Your correction (sensitivity) factor is programmed into the pump along with a target glucose. The pump will calculate the amount needed to help lower your glucose to your target.

INSULIN ON BOARD

Insulin on board is the calculation that determines how much insulin is still active in your body from previous bolus doses. When you give a bolus of insulin for food or for a high blood glucose, that insulin can remain active for three to five hours. Whenever you give a correction bolus, your pump will calculate the amount of insulin still active from the last bolus and deduct that from the recommended amount. This will prevent a "stacking of insulin" resulting in low blood glucose.

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EMERGENCY KIT

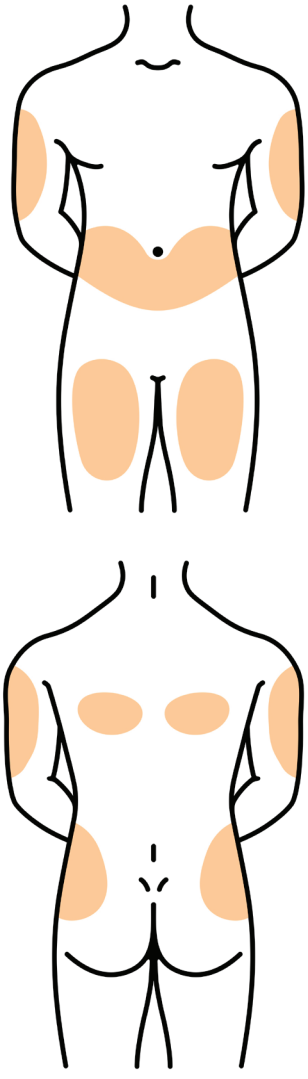
It's important to carry supplies with you at all times in case of emergency. Items to keep in your emergency kit should include:

- Insulin vial and syringe
- Extra reservoir/cartridge and infusion set (or Omnipod pod)
- Batteries or charging cable
- Glucose tablets or items to treat hypoglycemia

Examples of when you'll need to utilize your emergency kit include when the infusion set or pod falls off, unexplained hyperglycemia requiring an infusion set or pod change, an empty reservoir or pod, or loss of charge or battery life.

INFUSION SETS OR PODS

Prevention and Treatment of Skin Irritations, Infections and Tape Issues



It's important to rotate infusion sites, just like with insulin injections. Ideal sites include the hips and upper buttocks, outer thighs and back of the arms.

Some people may develop skin irritation from the infusion set or pod tape, which could result in an infection at the infusion site. To prevent or reduce this risk:

- Use a cleaning technique when changing your infusion set.
- Change infusion set or pod every two or three days.
- Check infusion site, tubing or pod site several times each day.
- If the site becomes red, change the infusion set immediately and place a warm compress over the old site. If you see signs of infection, such as drainage or pus, contact your primary care provider immediately.
- If infusion set or pod doesn't adhere, consider using I.V. Prep antiseptic skin preparation, Skin-Tac wipes or special overlay tape.

If skin irritation occurs (redness, itchy or dry skin) determine the source:

- Is it the tape? You may need to use a barrier prior to insertion of the infusion set, such as IV3000 transparent adhesive film dressing.
- Is it the alcohol wipe? You may want to use pump antibacterial soap to clean the area in place of the alcohol wipe.

* Call your diabetes educator if unable to determine the source of irritation.

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POTENTIAL CAUSES OF HYPOGLYCEMIA (LOW BLOOD SUGAR)

Insulin pump therapy may not eliminate all episodes of hypoglycemia. If you do experience one, try to figure out the cause to help prevent it in the future. Discuss with your diabetes care team if you experience frequent hypoglycemia, because you may need to change your pump settings.

Insulin Pump/Insulin Dosing

- Was your insulin bolus too high in relation to the amount of carbohydrate eaten?
  If so, your carbohydrate ratio may need to be changed.
- Was the insulin bolus too high when correcting for a high blood glucose?
  If so, your correction/sensitivity factor may need to be changed.
- Are you going low when you don't eat?
  The basal rate may need to be changed.

Food

- Did you correctly estimate the number of carbohydrates being consumed?
- Did you drink alcohol?

Exercise

- Did you compensate for exercise with either an insulin reduction or by eating additional carbohydrates to avoid post-exercise hypoglycemia?

TREATMENT OF HYPOGLYCEMIA

- ☐ If symptomatic, test blood glucose with a meter or check your CGM immediately.
- ☐ If using Tandem's Control-IQ or Medtronic's Auto Mode, you may not require as much to treat a low blood glucose. We suggest you give five to 10 grams of carbohydrate such as, two to three glucose tablets or ¼ cup of fruit juice.

  _____
- ☐ If not using the pumps mentioned above, you should treat with 15 grams of carbohydrate, such as, three to four glucose tablets or ½ cup of fruit

  _____
- ☐ Recheck your blood glucose (BG) level using your meter or CGM to evaluate the effectiveness of the treatment. BG should elevate 30 to 50 points after treatment.
- ☐ 15 minutes after treatment, if your BG is still less than 70 mg/dl, repeat the treatment.

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POTENTIAL CAUSES OF HYPERGLYCEMIA (HIGH BLOOD SUGAR)

Insulin pump therapy may not eliminate all episodes of unexplained high blood glucose (over 200 mg/dl). If you notice your BG elevated, try to figure out the cause and correct it as soon as possible.

Food

- Did you remember to bolus for all your food? Check your bolus history.
- Did you eat a meal that was high in fat? Discuss the use of the extended bolus with your diabetes care team.

Insulin Pump

- Did you program the basal rates, carbohydrate ratio and correction/sensitivity factor correctly? Always review after making any changes.
- Did the pump alarm? Review your pump's alarms.

Reservoir

- Is the reservoir or pod empty?
- Is insulin leaking at the connection to the tubing? An easy way to check for leaks is to place a tissue at the connection site. If it becomes wet, the connection is loose.

Infusion Tubing, Set or Site

- Did you prime the infusion set?
- Check for an insulin leak at all connections.
- Is there air in the tubing? Tiny bubbles are fine, but 1 inch of air = ½ unit of insulin.
- Is the tubing kinked?
- Has the infusion set been in too long? Change them at least every three days.
- Did the infusion set or pod become dislodged?
- Is there blood in the infusion set or pod?
- Is the cannula kinked or blocked? This can only be seen by removing it.
- Is the set in an area of hypertrophy? Avoid using areas with hypertrophy because the insulin will not absorb correctly.

Insulin

- Is it cloudy or have particles in it?
- Is it beyond the expiration date or has the vial been open longer than the maximum 28 days?
- Has it been exposed to extreme temperature?

IF YOU ANSWERED YES TO ANY OF THE ABOVE, YOU MUST CORRECT THE PROBLEM.

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TREATING UNEXPLAINED HYPERGLYCEMIA

- If your glucose levels are rising and not coming down after a correction bolus, *remove the infusion set to check if it was bent or kinked. Don't continue giving correction boluses via the pump.* Always check your BG one to two hours after changing your set.
- If glucose levels are above 250 mg/dl and have been for a few hours, *check urine for ketones* (if you've been instructed to do so by your diabetes care team).
  - *If ketones are small:* give a correction dose by injection.
  - *If ketones are moderate or large:* double the calculated correction dose or take 20% of your daily dose of insulin (check your history for the last several days to get an average daily dose). Administer it by injection *not* via the pump, or call the office for assistance.
- Drink at least eight to 16 ounces of fluids, such as water or sugar-free and caffeine-free beverages, every hour to help you stay well hydrated.
- Insert a new infusion set.
- Continue to monitor BG levels and ketones until you're under 200 mg/dl and your ketones are negative to trace.
- If BG levels aren't coming down, ketones remain, or you're not feeling well, call us at 508-334-3206 during regular business hours, or after hours call 508-334-1000 and ask for the endocrinology fellow on call.
- Have a source of fast-acting glucose available to use if the correction dose makes you go too low. Follow usual guidelines for treatment of lows.

BE PREPARED

Always Have the Following Available

- ☐ Insulin vials or pens - both long-acting (in case of pump failure) and rapid-acting
- ☐ Syringes or pen needles
- ☐ Ketone strips
- ☐ Glucagon
- ☐ Blood glucose test strips
- ☐ Fast-acting glucose, such as glucose tablets, juice, glucose gel, etc.

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