

Insulin pumps – frequently asked questions



1. What is an insulin pump?

Insulin pump is a portable electronic device attached to the body that delivers required quantities of rapid acting insulin analog via a catheter placed under the skin. It can be used as an alternative to insulin injections in patients with diabetes mellitus.

2. How does it work?

The pump has 3 components

- a. An electronic device with a screen and buttons to program the insulin quantity and delivery rate.
- b. A reservoir inside the device, which stores rapid acting insulin analog.
- c. An infusion set, which contains a thin plastic tubing that, delivers insulin from the reservoir into the subcutaneous tissue via a plastic cannula inserted beneath the skin.

3. How does the pump deliver the insulin?

Insulin pumps use only, usually rapid acting insulin analog. But there are two different types of doses: basal and bolus.

The basal dose acts as a background dose of insulin, same way as the pancreas acts in a non-diabetic person. This steady dose of insulin is needed to counteract the steady of flow of glucose into the blood provided by the liver through the day.

The bolus is the dose of insulin that is specifically taken at meal times to help control blood glucose levels following a meal

By pressing a few buttons, the pump is programmed to deliver continuous basal rates of insulin as well as bolus doses of insulin during mealtime as well as in periods of hyperglycemia.

4. What is bolus wizard?

Bolus wizard is insulin pump's in-built software programme that helps to calculate insulin dosage. The system is to go for.... pump controls and select bolus wizard, input blood glucose reading, input estimated carbohydrate intake and it will suggest a bolus (or dose) based on that information.

This implies that the patient counts the carbohydrate content of food she or he is eating which is called as carbohydrate counting.

The basal rates are already programmed in the software. The carbohydrates: insulin ratios have to be fed into the software to calculate the bolus doses of insulin for the next meal. The insulin dose required for specific quantity and type of food in grams of carbohydrates varies from patient to patient, and can be decided with consultation with the doctor, dietician and diabetic care nurse, pump trainer [carbohydrate counting]. e.g. some patients require 1 unit of insulin for every 6g of carbohydrate intake, some for every 10 g of carbohydrate. However, one can also empirically fix the bolus doses without such intricate calculations as is done in patients taking insulin by injections.

5. How is the pump different from insulin injection?

In insulin pump, the patient just presses the buttons of device for insulin delivery [painless!!]. Only the infusion set and cannula needs to be changed every 3 to 5 days.

In insulin syringe and pen injection devices, every time a subcutaneous injection is needed to deliver insulin. The needle needs to be changed every time ideally.

6. Who are the patients who would benefit from insulin pump?

- a. All type 1 diabetes patients who require lifelong daily insulin injections.
- b. Type 2 diabetes patients particularly those who despite taking 4 or 5 insulin shots per day, have poor glycemic control, wide fluctuations in blood glucose and unmanageable hypoglycemia.

- c. Patients who need flexibility in food timings, shift change jobs, sports, moderate to severe physical activities daily as part of work.
- d. To reduce hypoglycemic events.
- e. To achieve good control of glucose levels and HBA1c in patients who have very erratic glucose values in spite of regular insulin injections and tablets.
- f. It is suitable even in infants with type 1 DM.
- g. For better glucose control during diabetes in pregnancy, especially those women requiring very high doses of insulin or struggling to maintain strict glycemic control that is needed in pregnancy.

7. What are the advantages of insulin pump?

- a. While on injections, patients require at least 30 to 150 shots per month; the pump requires a catheter change only once every 3 to 5 days. And there is no need to associate every meal with a needle.
- b. Because the cannula stays implanted, there is no need for additional injections during an additional food or during an illness.
- c. The pump can be set to deliver different rates of basal insulin at different times of day. e.g. for treating early morning hypoglycemia, night time basal dose alone can be decreased .
- d. Flexibility with food e.g. with an occasional dessert, the dose can be adjusted.
- e. Flexibility with exercise, i.e. the dose can be decreased before an exercise
- f. Better glucose control and HbA1c reduction with less degrees of interday and interday variability
- g. Reducing episodes of hypoglycemia.
- h. Reduces the risk of complications of diabetes

8. What are the disadvantages of insulin pump?

- a. It is costly.
- b. Can cause hyperglycemia if the catheter comes out and patient does not get insulin for hours
- c. May be bothersome for some patients who feels difficulty in carrying the pump to work, for cosmetic reasons and also being attached to a device with cannula most of the time.
- d. Can cause skin irritation, infection over the insertion site and catheter block if the infusion set is not changed every 3 to 5 days.
- e. Using a pump is not worth its full unless that is backed up with repeated blood glucose monitoring either by way of self-monitoring of blood glucose or by continuous glucose monitoring, which many patients may not like. However, in stable

and complaint patients a pump can functional reasonably well even without intense home blood glucose monitoring though that should not be encouraged.

9. How costly are they?

- a. The insulin pump devices' cost ranges from 1.5 lakhs INR to 3.3 lakh INR.
- b. The consumables and maintenance cost is approximately 3000 INR per month.
- c. However insulin pumps are cost effective. A patient-using pump does not have to inject costly basal insulin analogs like glargine or degludec. Secondly, overall daily insulin requirements decrease by 10-30%, thereby effecting long term direct cost savings. The indirect cost benefits of the pump are a better quality of life with reduced episodes of hypoglycemia, the freedom for the patient from giving insulin injections at right time in precise doses during work, home, and recreation. To the physician the main advantage of pump is the potential of near physiological pattern of insulin delivery incorporating a wide vista of flexible dosing that is unimaginable with any kind of insulin regimen.
- d. Hence the patient can work into his full capacity or increased capacity compared to past difficulties and also enjoys an injection free life and finally resulting in a fully efficient productive life.

10. What are the consumables?

Insulin pump reservoirs pump batteries, infusion sets (including cannula and tubing), and skin dressings, adhesives

11. Is the pump too technically sophisticated and difficult to use?

No the pump is not difficult to use.

Of course, the pump is an electronic device requiring certain basic and advanced setups, and thereafter-regular maintenance settings, but with any other modern electronic device [e.g. a smart phone!!] the patient gets trained and used to it.

The authorized insulin pump trainer and the treating physician initially give the complete demonstration and education. Subsequently they will be willing to help to get fully accustomed to pump. Helplines via phone, email are always available.

12. What are the insulin pump problems and troubleshooting?

- a. Bubbles in insulin pumps: can deliver less insulin than programmed. Taking care to prime out air from the reservoir and tubing, ensuring all connections are tight and using insulin that is at room temperature removes bubbles.
- b. Block: the pump may sound alarm, and less insulin is delivered. Check for kinking, pressure on infusion site. Changing your infusion site may be necessary, such as if the cannula has become kinked. Call your health team for help if you are unable to resolve the issue or you are getting occlusions occurring too frequently.
- c. Insulin pump reservoir leak: This can happen if the rubber seals, around the plunger become weak or damaged. The seal or plunger or reservoir needs to be changed.

d. Infusion sets coming loose are relatively common because of sweat accumulation. A more durable adhesive is to be used.

e. Skin infections at the insertion site: Taking care to clean the skin of infusion site and hands when changing a set will avoid skin infection. Keeping the cannula at same site for more than recommended duration [5 days] can also cause skin infection, irritation

13. What are the types of insulins used in pump?

Rapid [short duration] acting insulin is used. They are usually insulin analogs e.g. lispro, and aspart.

14. What about bathing, exercise and sleeping with a pump?

When it comes to bathing one can disconnect pump while having bath or to keep pump on, but to take precautions to prevent pump getting wet or too warm.

Insulin pumps offer distinct benefit for exercise. The chance to increase or decrease the rate of insulin you receive before, during and after exercise can be changed with type, duration of exercise and also with relation to food and liquid taken around exercise time. One needs to secure properly the pump during exercise and sports, which is easy to do, to avoid kinking of tubes.

It is safe to use pump during sleep. The patient gets used to with the pump and infusion set during sleep easily. The tubing usually is not affected when the patient rolls over. Besides to prevent early morning anxious hypoglycemic events, insulin pump is the best option. The patient can have a complete undisturbed sleep cycle.

15. What are the lifestyle issues in patients using pumps?

The quality of life is very good in patients who use insulin pump. Some patients carry it exposed in pocket or in waist belts where it can be comfortably placed. In patients who need to hide the pump, options are available to keep in special pouches inside the dress or directly over skin using belts. The patient can lead a normal life as of a non-diabetic with good glucose control and prevention of complications with full efficiency and satisfaction.

16. Lastly which patients of diabetes benefit from the pump?

Just as there is no absolute contraindication to insulin administration via pump or continuous subcutaneous insulin infusion (CSII) as it is technically called, type 2 or type 1 subjects or patients with diabetes in pregnancy uncontrolled on multiple daily insulin injections, having unacceptable hypoglycemia and glycemic variability, requiring high doses of insulin and those who are motivated and willing for good metabolic control would be ideal candidates for the pump.

Suggested reading

1. <http://www.diabetes.co.uk/insulin/Insulin-pumps.html>
2. <http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/insulin/insulin-pumps.html>
3. <http://www.joslin.org/info/insulin-pump-program.html>
4. <http://www.medtronicdiabetes.com/treatment-and-products/insulin-pump-therapy>

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