ACCU-CHEK® Infusion Sets

Roche

Guide to Infusion Site Management

Infusion Set Basics and Site Management DVD Inside!

ACCU-CHEK®

Guide to Infusion Site Management

This guide is designed as a reference for healthcare professionals and the insulin pump wearers they work with. There may be several equally valid methods regarding infusion site management for arriving at the same therapeutic outcome. In this guide, we describe the most commonly used techniques. Experience will validate the most appropriate method for each individual situation, and patients should consult their healthcare provider before making any changes to their current practices and regimen.

Please note: Advice in this guide is based on using fast- or rapid-acting insulin, which insulin pumps are designed for. The consistent flow of the basal rate provides the background insulin in lieu of long- or intermediate-acting insulin.

Please consult product information guides to find detailed handling information for the specific products mentioned in this guide.

Table of Contents

"A lot of people starting out on the pump don't realize that problems with infusion catheters are the number one cause of unexplained high blood glucose. Using the right type of catheter and skin tape can greatly reduce this risk."

From *Smart Pumping*, edited by Howard Wolpert MD, American Diabetes Association, 2002.

"Successful pumping is dependent upon successful infusion sets."

Margaret M. Ulchaker, MSN, RN, CDE, CNP, NP-C, BC-ADM

"Trouble shooting labile/elevated blood glucose levels in the pump patient should always invoke consideration of inconsistent insulin delivery due to infusion site problems. After optimizing dietary factors, appropriate compensation for variable exercise, in addition to tweaking the multiple basal rates and meal/snack boluses, the insulin pump healthcare team may be at a loss to explain persistent glucose lability. While a pump mechanical problem is possible to explain inconsistent insulin delivery, the majority of the problems are related to infusion site issues. Careful attention to all the elements outlined in the monograph will be of major assistance to the insulin pump healthcare team in tracing the source of infusion site related glucose lability."

John P. Sheehan, MD, FACE, FACN

Getting Acquainted with Infusion Site Management

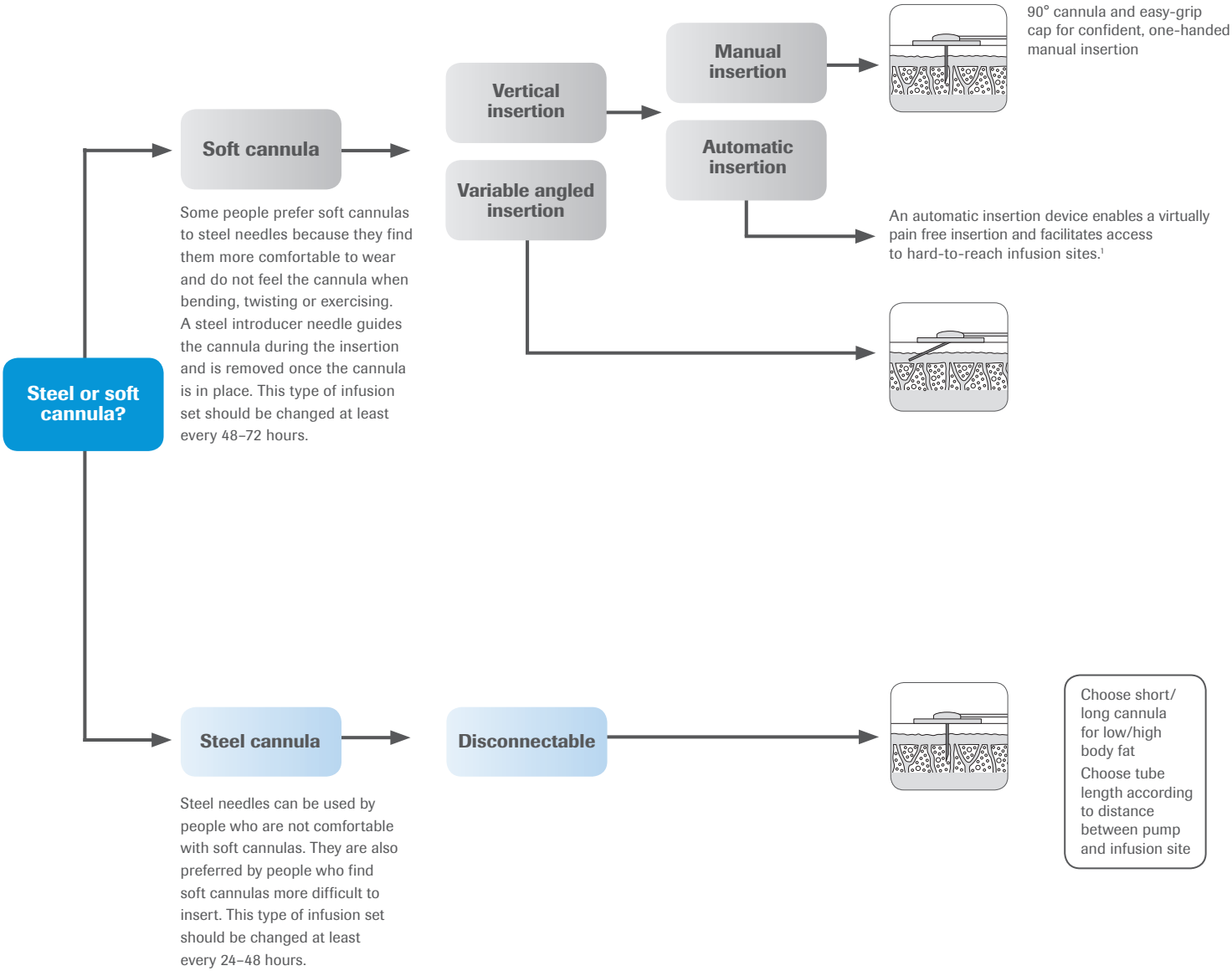
Infusion sets carry insulin from the pump to the body. It's an important job, so it's important to know how it works.

Despite that fact, many healthcare professionals and their patients do not devote enough time to fully understanding the infusion set itself or the wide range of issues related to infusion set usage and infusion site management.

Infusion sets are available in many different designs and combinations of cannula and tubing lengths for different body types, lifestyles and activity levels. And new designs are available on a regular basis.

This guide is designed to help you educate your patients on infusion sets, their usage and how they fit into daily life with diabetes. You will also get tips on infusion site management and troubleshooting to help make using an insulin pump a safe, successful and therapeutic regimen for your patients.

Infusion Sets and Their Features



Infusion sets offer a number of different design features, each with their own benefits. And when you understand those features and benefits, you're better able to help your patients choose the infusion set that matches their lifestyle.

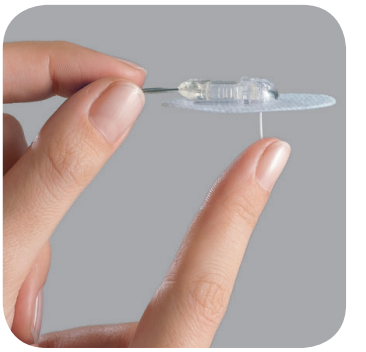
Infusion set decision tree
This simple chart can help you recommend a pump user's first ACCU-CHEK® infusion set.

Universal versus proprietary sets

- Most infusion sets on the market are universal; they use a luer-lock connection that can be used on pumps with a standard luer-lock fitting.

- The Medtronic's MiniMed Paradigm® pump is an example of a pump that uses a proprietary infusion set– the connection is not a universal luer-lock fitting. Therefore, only sets made for use with this pump can be used. There are, however, adapters that allow Medtronic sets to be universal.

Steel versus soft cannula



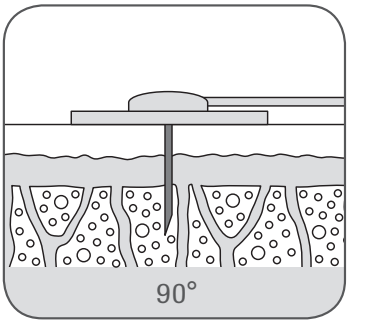
- Steel cannulas are made surgical stainless steel, which can contain as much as 8 to 12 percent nickel. So patients with allergies to metal should use caution when trying this type of infusion set. Signs of an allergic reaction include redness, itchiness or mild pain. Steel cannula sets are often recommended for beginners or patients who have had problems with soft cannula sets in the past.
  Such problems could include bending or crimping of the cannula, which is identified by frequent occlusion alarms or a visible crimp or bend upon removal of the soft set. **Steel cannula sets should be changed every 24 to 48 hours.**

- Soft cannula infusion sets use a stainless steel introducer needle to guide a soft, flexible cannula into the tissue. The introducer needle is then removed and only the soft cannula stays in the adipose, or fatty, tissue. Soft cannula sets are more popular than steel cannula infusion sets, are generally considered to be more comfortable, and are good for those prone to allergic reactions to nickel. **Soft cannula sets should be changed every 48 to 72 hours.**

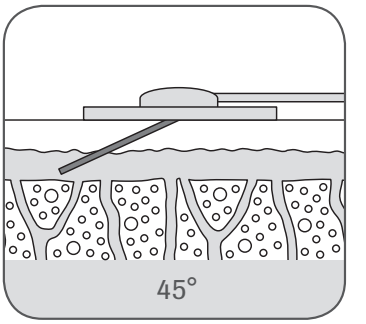
Adhesives

Some people may be allergic to the adhesive in the head-set dressing or the glue used to make infusion sets, so trial and error with different products is recommended to determine individual sensitivity. ACCU-CHEK infusion sets use different adhesive material to offer the possibility to switch between different products in case of allergic reactions.

90° versus angled insertion



- 90° infusion sets are inserted into the skin at a 90° angle and have a shorter introducer needle. This type of set is good for quick insertion and for people who are uncomfortable with needles. Most 90° sets can also be used with insertion devices.

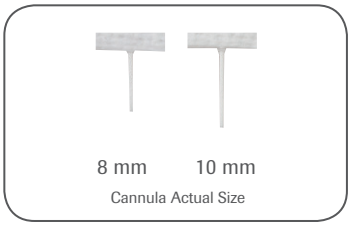


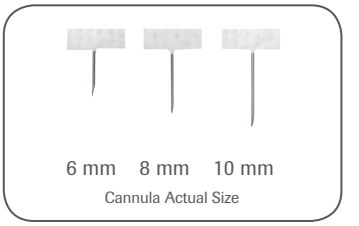
- Angled infusion sets are inserted at a 20° to 45° angle to the skin and have a longer introducer needle. This type of set is good for slow insertion and to provide a greater variety of infusion depths to accommodate differences in skin tissue between patients of different ages and weights.

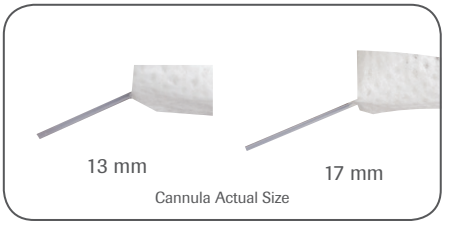
- Regardless of the type of infusion set or whether the patient inserts it quickly or slowly, the set should be inserted in one smooth motion.

Cannula lengths

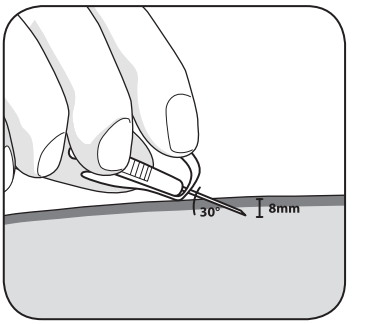
Straight and angled infusion sets come in two to three different lengths to account for differences in skin tissue.

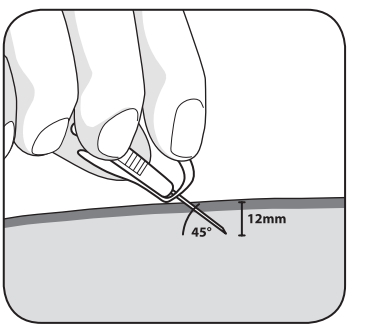






Type of patient	Body mass index (BMI) kg/m²	Recommended cannula length	
		Straight cannula (90°)	Angled cannula (20°–45°)
Children (<12 years old)	Any	6 mm/8 mm	13 mm
Adolescents and adults	< 25	6 mm/8 mm	13 mm
	25 – 27	8 mm/10 mm	17 mm
	>27	10 mm	17 mm





The above table shows recommended cannula lengths based on various body mass index (BMI) levels. Please note that these recommendations are not absolute; careful monitoring by a healthcare provider is required to ensure proper cannula length for each patient.

Insertion depth

When using angled sets, both the angle and depth of insertion can be adjusted and may slightly differ with each insertion (see example at right with 17 mm soft cannula). Therefore, a healthcare provider should help determine the correct depth for each patient when using angled infusion sets. With 90° (straight) infusion sets, insertion depth is consistent each time.

Tubing length

Most infusion sets come with a variety of tubing lengths to fit different body sizes and to allow the patient to wear the pump in a variety of places. It is important to ensure that there is enough tubing to easily perform everyday activities, such as using the restroom. Please note that infusion set tubing may not be interchangeable among brands or types of infusion sets, and patients should use the tubing specifically designed for their particular infusion set to avoid problems.

Packaging options

Some sets are packaged with tubing, and some have extra head sets packaged without the tubing, which can save on costs for patients. This packaging is designed to allow changing of the steel cannula every one to two days and soft cannula every one to three days, as recommended, while using the insulin tubing for up to six days. See product instructions to determine correct usage.

Tubing priming volume

Infusion sets are packaged with a variety of tubing lengths and therefore require different filling volumes. The longer the tubing, the more insulin it takes to fill. Some infusion set tubing is co-extruded, which means that there is a tube within a tube, creating a smaller inner diameter. This kind of tubing requires less insulin to fill and is less likely to kink and obstruct insulin flow.

Insertion technique

Some patients prefer a quick insertion while others prefer a slow, controlled insertion. Regardless of the insertion technique, the infusion set should be inserted in one smooth motion. Consistency is the key.

- One-handed versus two-handed insertion
  - Infusion sets that can be inserted with only one hand are useful for:
    - Patients with dexterity problems or who can use only one hand
    - Site placement in hard-to-reach areas
  - Generally, steel cannula sets inserted at 90° can be inserted with one hand, because it may not be necessary to pinch up the skin upon insertion.

Insertion devices

Every patient must be able to insert an infusion set without the help of an insertion device, in case the device breaks or cannot be used. However, insertion devices can provide virtually pain-free and more consistent cannula placement.[1] They're especially helpful for:

- Children or people with needle phobia
- People with dexterity issues or unsteady hands
- Insertion in hard-to-reach areas, such as the hips or upper buttocks.

As helpful as insertion devices are for some people, it must also be recognized that insertion devices:

- Apply the same insertion force, regardless of skin thickness
- If disposable, are more expensive and add to waste
- Should not replace a patient's ability to insert manually
- Allow only one insertion angle for angled infusion sets, as opposed to a varying degree of angles with manual insertion.

Choosing an Infusion Site

Site selection is one of the most important parts of infusion site management. If done successfully, it sets a patient up for better insulin flow and a lower risk of infection. So teach your patients how to choose their sites wisely.

Recommended Areas and Absorption Differences:

Certain areas are recommended more than others because of their insulin-absorption capabilities, comfort and convenience:

Abdomen

- Best absorption area

Hips and buttocks

- Slower absorption than abdomen, but excellent for people who are very active or who have low body fat

Outer thighs

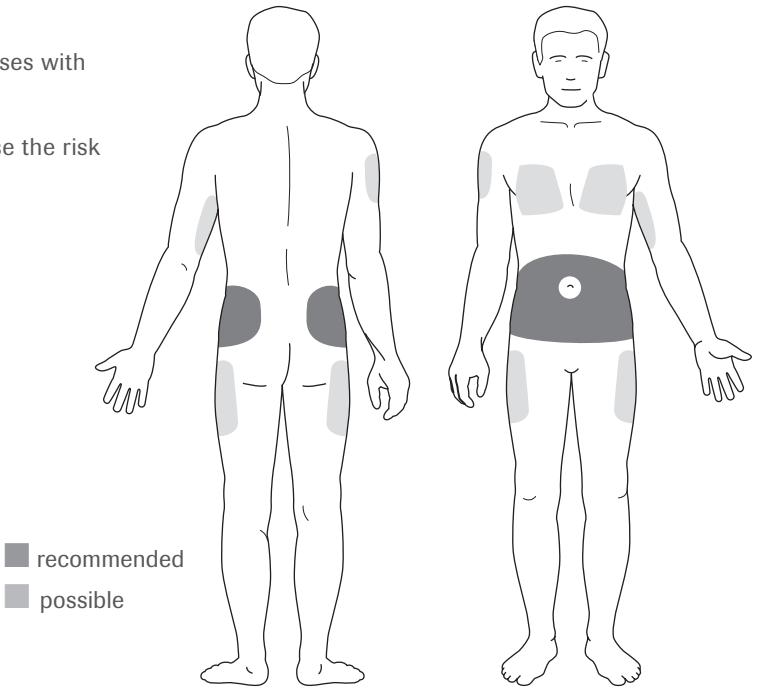
- Slower absorption than abdomen, but absorption mechanism increases with muscle group exercise
- Use of the inner thigh area is not recommended since it can increase the risk of irritation and infection.

Back of the arms

- Slower absorption than abdomen, but may accelerate with activity
- More difficult to use if two hands are required for insertion
- May be difficult to navigate tubing

Breast tissue

- More rotation and placement options
- Absorption similar to upper buttocks
- A not exercised area, which is a good idea for active people



Areas to Avoid:

- Within two inches of a recently used site
- Within two inches of belly button
- Highly sensitive areas
- Highly exercised areas
- Under a waistband of clothing
- Exposed to rubbing or bumping
- Over a bone
- Blood vessels
- Scar tissue/surgical scars
- Stretch marks
- Fatty tissue overgrowth
- Previously infected areas (avoid for at least one month)
- Bruised areas
- Liposuction
- Body piercings
- Tattoos

Preparing an Infusion Site

Three Steps to Teach Your Patients:

1. Trim

Body hair around the infusion site leads to poor tape adherence and painful removal. So make sure any hair around the insertion area is trimmed or shaved with an electric razor (other types of hair removal may lead to skin irritation or infection).

2. Clean

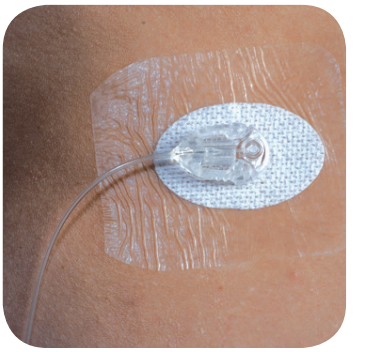
It's important to start with a clean workspace with no pets around and with clean hands that are completely dry. Use a sterile prep pad or alcohol swab to cleanse the insertion area. Move the pad in circles away from the chosen insertion site, cleaning an area about the size of a tennis ball.

3. Dry

It's important to allow the site to air-dry for at least 60 seconds. DO NOT blow or wave on the site, as it increases the risk of infection. A clean and dry site also means the infusion set can stick to the skin.

Site Preparation

Special Site Preparation:



For excessive perspiration, humidity and very active patients:

- Use a tacky prep pad and allow the site to dry completely.
- Use antiperspirant (not deodorant) around the tape area, not directly at the insertion site and allow the antiperspirant to dry before inserting a set.
- Use the sandwich technique: Cleanse the skin using an adhesive wipe and allow it to dry. Cut a small hole in an extra piece of dressing, and insert the infusion set through the hole so that it does not pierce the dressing. Adhere the infusion set adhesive, and cover the set with another sterile dressing to sandwich the infusion set.

For patients prone to infection:

Patients who are prone to infection or are on immunosuppressive agents or antirejection medications should watch their infusion sites closely for signs of infection and change out their set more often.

These patients can also perform a triple-preparation procedure:

1. Wash hands and the insertion area with an antibacterial soap and let dry. Place a clean towel down and put any supplies that will be used on top.

2. Next, cleanse the area with an antibacterial solution and let dry.

3. Apply an antiseptic and adhesive wipe to the area and let dry.

For patients who are uncomfortable with needles:

Patients can numb the skin at the infusion site with a topical anesthetic, or simply with ice, to make insertion more comfortable for them. They should, however, be capable of inserting a set without numbing their skin in case of an emergency.

Inserting an Infusion Set

Once the infusion site is clean and dry, it's ready for insertion. Teach your patients these simple steps:

1. Prepare

NEVER use a previously opened package. Always use a new sterile infusion set. Remove the set from its packaging.

Stand or sit up straight during the insertion process. The skin around the infusion site can be pinched or stretched for easier insertion. If the skin dimples on insertion, stretch, rather than pinch the skin.

2. Prime

Air bubbles in the tubing can lead to missed insulin delivery, resulting in unpredictable blood glucose levels. While disconnected from the infusion set at the body, prime the tubing until a bubble exits the infusion set and two large drops come out. Allow the drops to hit the back of the hand for further confirmation. Give the luer-lock a gentle twist (don't tug) to make sure it is snugly in place.

3. Insert

Depending on the infusion set, the cannula should be inserted straight into the skin or at a 20° to 45° angle. See insertion techniques on page 7.

If using an insertion device, follow the instructions for that device. If inserting manually, insert the set into the skin in one smooth motion.

4. Smooth

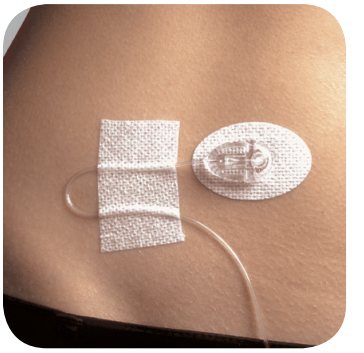
The adhesive dressing on the infusion set should then be resting against the skin. Smooth the adhesive to make sure it has made good contact.

5. Connect

Next, hold the tape against the body with one hand, and attach the tubing to the infusion set with another. Most infusion sets have an audible click when they're connected. In addition, do a quick visual check accompanied by a gentle tug on the tubing at both the pump connection and infusion set connection.

6. Prime bolus

Patients using a soft cannula infusion set need to do a prime bolus of 0.7 units (or according to manufacturer instructions) in order to fill the airspace in the cannula where the introducer needle once was.



Blood glucose levels should be checked one to three hours after insertion. You should NEVER change a set right before bedtime. A good time to replace an infusion set is just before a meal, as a required bolus will clear any tissue that might have become lodged in the cannula during insertion. Another good time to change a set is right after a shower, as clean, exfoliated skin helps with adhesive adherence.

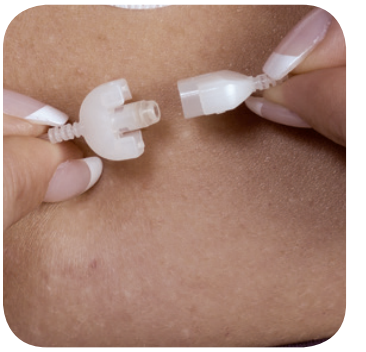
For extra protection in case the tubing is accidentally pulled, tape a loop of tubing to the skin near the site. See example at right.

Disconnecting

Most patients find they can do a lot of daily activities just fine while still connected to their insulin pump. But there are some situations in which it's wise to disconnect:

- Certain sports (especially those with physical contact)
- Swimming/showering (including hot tubs, lakes and oceans)
- Sexual activity
- Scanning (CAT scan, MRI, etc.)
- Tanning beds
- Roller coasters

How to Disconnect:



1. Put the pump in stop mode

Leaving the pump running while disconnected can result in inaccurate calculations as the patient will have missed a portion of their insulin delivery. This is particularly true if the patient disconnects while in the middle of an extended or multiwave bolus.

2. Disconnect at the infusion site

Never disconnect the tubing at the pump while the infusion set and tubing are still connected to the body. Always disconnect at the infusion site. Do so by gripping and gently squeezing the clip that connects the tubing to the infusion set and pulling away.

3. Cap off infusion set

Always cap off the infusion set, using the protector that comes with the set when swimming, showering or engaging in sexual activity to prevent infection and to keep foreign substances away from the infusion set.

Reconnecting

How to Reconnect:

1. Prime bolus

To prevent backflow of insulin, patients should take a one- to two-unit bolus while the tubing is connected to the pump but disconnected from the infusion site. They should also visually confirm insulin flow by letting a few drops of insulin come out of the tubing and hit the back of their hand.

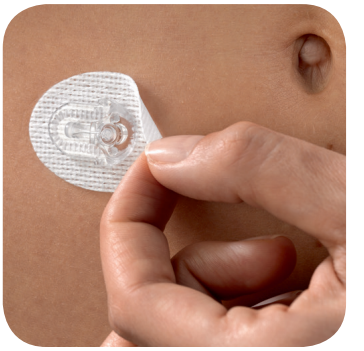
2. Connect

If a patient's infusion set has been capped, he or she should remove the cap before reconnecting, then connect the tubing to the infusion set. Most infusion sets have an audible click that signals a secure connection. Patients should also do a visual check and give the tubing a gentle tug to make sure it is snuggly in place.

3. Make adjustments

Usually patients only need to make adjustments if they've been disconnected from their pump for an hour or longer. Insulin-dosing adjustments should be made according to blood glucose levels.

Removing an Infusion Set:



1. Disconnect

When patients are ready to remove an infusion set altogether, they should disconnect the tubing from the infusion set at the body, as discussed on page 24.

2. Remove the head set

Patients can plan site changes around their shower schedule so that the warm water starts working on the adhesive that holds the set onto their skin. They can also use adhesive remover or baby oil to loosen the set. Once it's loose, the head set can be removed by holding the skin tight and peeling from the edges of the dressing to the center. After the set is removed, the cannula should be inspected for kinking or blood.

3. Dispose of the set

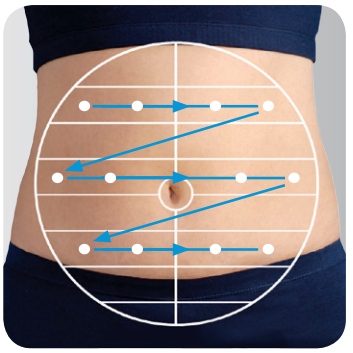
Patients should always dispose of an infusion set safely and according to local biohazard material regulations. No part of an infusion set should ever be reused.

Post-Removal Skin Care:

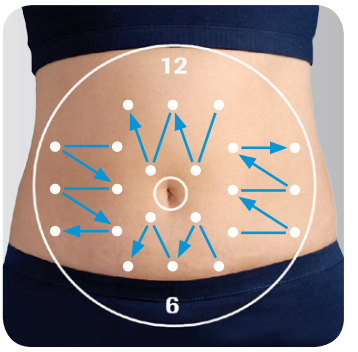
After removing their infusion set, patients can apply antibiotic ointment for extra protection against infection and a moisturizer to keep the skin hydrated. Adhesive-removal products will remove excess buildup as well. An infusion site should not be used again for at least two weeks or until it has fully healed. If the patient experiences a pump bump (see page 31 for more on pump bumps) or infection, they should wait at least one month before using that site again.

Infusion Site Rotation

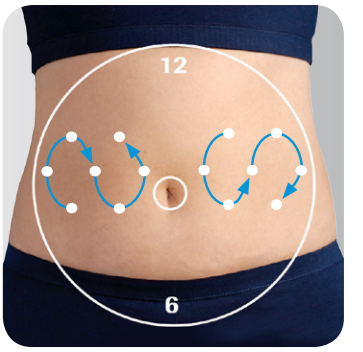
Choosing a new infusion site every time allows the skin to recover, ensuring that insulin absorption in any area does not suffer from too intensive use. In general, an infusion site should be allowed about two weeks to heal, sometimes more if it's infected or scar tissue has formed.



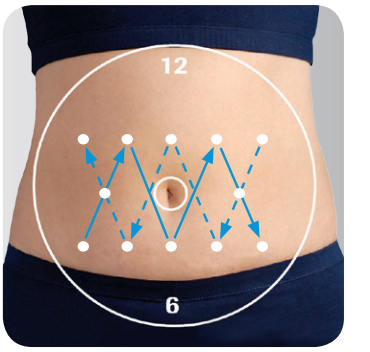
Horizontal Pattern



Zigzag Pattern



Curve Pattern



Crisscross Pattern

Disclaimer

This guide is designed as a reference for healthcare professionals when initiating insulin pump therapy in an outpatient setting. We have selected current accepted clinical practices for infusion site rotation. Healthcare providers should become familiar and comfortable with rotation patterns and apply them to their practice in order to secure optimum results as they train patients.

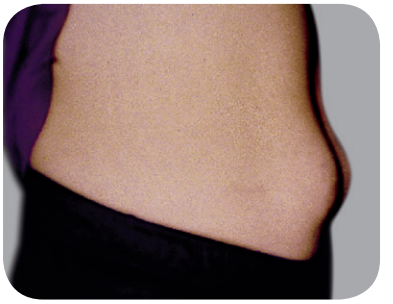
Using a pattern can help patients remember which sites they've used and which ones to use next. Some site rotation patterns that will make the best use of the available skin surface are shown above. Patients should find a system they're comfortable with, even if it's not one of these four.

Patients should always avoid choosing a site less than two inches (5 cm) from a recently used site, the area under a waistband and the area within two inches (5 cm) of the belly button. Other infusion site limitations are listed on page 15.

Consequences of Poor Site Rotation:

- Increased risk of repeated infection
- Increased blood glucose levels (hyperglycemia)
- Poor insulin absorption
- Tissue/skin damage
- Changes of the skin structure, such as scar tissue (which makes insulin absorption unpredictable)
- Lipohypertrophy, a swelling caused by an increase of fat cells at the infusion site, which results in poor absorption and increased insulin use

Front View



Side View

Special Considerations for Site Rotation:

- Insulin amount adjustments may be necessary when choosing a new insertion area. Switching from a frequently used insertion area to a previously unused area might require a lower basal rate. Patients should check their blood glucose levels more often when using new infusion site.
- Pump users may prefer different types of infusion sets for different sites. For example, they may prefer using an angled infusion set for the abdomen and a 90° set for the hip area.
- “Pump bumps” are small spots that feel like small frozen peas under the skin. They are the body’s natural reaction to a foreign object and generally occur when a set has been left in too long. They disappear over time, but until they can no longer be felt, that area should be avoided.
- Reminder: **Patients must change steel cannula sets every one to two days and change soft cannula sets every two to three days** (or sooner, if an infection or other circumstance arises).
- Remind your patient that if they cannot remember the last time they changed their site, it is a good time to change it. A good rule to follow is, “When in doubt, change it out.”

Special Infusion Site Management Situations:

Tips for pump users who are athletes

Athletic patients should avoid placing the infusion site in areas that have a higher risk of being bumped or otherwise dislodged and should avoid using a site around the muscle group they will be exercising. Also, they should consider using a safety loop, as described on page 22.

Patients should check their blood glucose levels and infusion site more often during athletic activity and may need extra tape to hold their set in place.

Tips for pump users with pets

Cats, dogs and other pets can be intrigued by the infusion set tubing and can easily tug on the tubing, potentially dislodging the infusion set. Also, patients should be cautious of kinks, bends or bites in the infusion set tubing. These can lead to reduced and/or unpredictable insulin flow.

Tips for pump users with impaired vision and/or dexterity problems

Using an adhesive wipe will help the patient identify the selected, cleansed area by feeling for the tacky skin that remains after an adhesive wipe is used. Also, most infusion sets have an audible click when the set is connected to the tubing.

Patients with impaired vision or dexterity issues may want to place their infusion sites in areas that are easy to access and where a set can be inserted with one hand, such as the abdomen. And these patients should turn to their healthcare provider for more advice.

Special Situations

Tips for pregnant pump users:

Site selection

One woman's experience with pregnancy and infusion site management can be very different from the next. In general, though, managing infusion sites during the first trimester is similar to doing so when not pregnant. As the baby and the patient's abdomen grow, the woman might feel more comfortable choosing sites along the sides of her abdomen, upper buttocks, legs and back of her arms, rotating them appropriately. Using sites on the abdomen will not hurt the baby, but using areas with stretch marks or tight skin that a patient cannot pinch is not recommended.

Blood glucose

Since blood glucose levels are often unpredictable during pregnancy due to hormonal changes, it's important for pregnant patients to check their levels often and make adjustments as needed and as recommended by their healthcare provider.

Changing sets

It is recommended that pregnant patients change their infusion set every 24 to 48 hours or more frequently. Many women find a deeper insertion angle is needed and use a longer cannula. Pregnant women decisions should base their decisions on the advice of their healthcare provider.

Situation	Solutions and Suggestions for the Pump User
Rash/itching	• Could be due to loss of protective skin oils with use of alcohol or soap; cleanse the skin and create a barrier using antiseptic and adhesive wipes.
Lumps under the skin	• Change infusion sites. • Consider covering the area with a topical antibacterial ointment; observe and monitor the area for infection. Do not wear the set longer than recommended, and follow a consistent site rotation plan.
Pump bumps—red or white spots at the point of insertion	• Do not wear the infusion set longer than recommended, and follow a consistent site rotation plan. • Observe and monitor the area for infection. Change infusion sites, the type of infusion set or the type of insulin.
Burning during a bolus	• If the bolus is large, use an extended bolus or deliver the bolus in 2 equal parts before and after the meal. • Try a different type of infusion set or a shorter cannula.
Dressing does not stick well	• Make sure site is clean and dry prior to insertion. • Apply an extra-strength adhesive. • Use the sandwich technique: cleanse the skin using an adhesive wipe; allow to dry; apply a sterile dressing; insert the set into the dressing; cover the set with another sterile dressing to sandwich the infusion set.
Dressing sticks too well	• Carefully remove dressing after loosening with a skin-friendly adhesive remover or baby oil to prevent skin irritation. • Run warm water over dressing in the shower to help loosen the adhesive.
Bleeding or bruising at the site	• Bruising at the site: replace the set and tubing and change infusions sites: do not rub the area; do not use the area for future site placement until the bruising has completely disappeared. • Blood in cannula or tubing: replace the set and change infusion sites; change tubing, if necessary. • Bleeding from insertion site upon removal: apply firm pressure to the area with a sterile cloth; do not rub the area.
High blood sugar response after site change	• Check for air bubbles, and check if the infusion set was completely primed. Move the new infusion set to a different site; attach the tubing to new site; prime for the airspace; leave the old infusion set in the skin for 1–2 hours after the new set has been placed to allow for complete absorption of remaining insulin.
Insulin leaks out of site once set is removed	• The needle might not be placed deep enough; change infusion sites and/or try a longer cannula or deeper placement.

Preventing Infection

Patients Should Keep Their Eyes Open for Signs and Symptoms of Infection:

- Elevated blood glucose levels (unexplained)
- Redness at the site
- Heat sensations around the site
- Swelling under the skin
- Pain, discomfort or itching

If any signs of an infection are noticed, a patient should change their set and contact their healthcare provider immediately. And remember, the rule is, “When in doubt, change it out.” Early detection and treatment with an antibiotic keeps a small infection from developing into an abscess, which could require surgery or hospitalization.

Quick Tips for Patients on Avoiding Infection:

- Always have clean hands when dealing with infusion sets and sites.
- Keep all parts of the infusion set clean. Do not touch the infusion set needle or other parts that are in contact with insulin.
- Follow proper infusion site preparation techniques according to the infusion set instructions and the recommendation of a healthcare provider.
- Avoid touching or breathing on the infusion set cannula and the insertion area when preparing the site; allow the prepared site to air-dry for at least 60 seconds prior to inserting the infusion set.
- Never keep sets in longer than recommended.
- Never reuse any part of an infusion set.
- Never use an infusion set if the seal on the package is broken or the expiration date has passed.
- Always make sure the dressing is securely stuck to the skin.
- Inspect the site frequently for problems.

Troubleshooting

A pump will alert its wearer of an error like an occlusion (see the chart on page 40 for troubleshooting occlusions and obstructions), but it's up to the patient to notice when something is out of the ordinary.

Signs to look for include:

- Two unexplained high blood glucose readings in a row
- Itching
- Burning
- Pain
- Blood or air in the tubing
- Dislodged cannula
- Wet head set dressing

If a patient notices any of these signs or any abnormality or issue with their set, they should change their infusion set immediately and contact their healthcare provider.

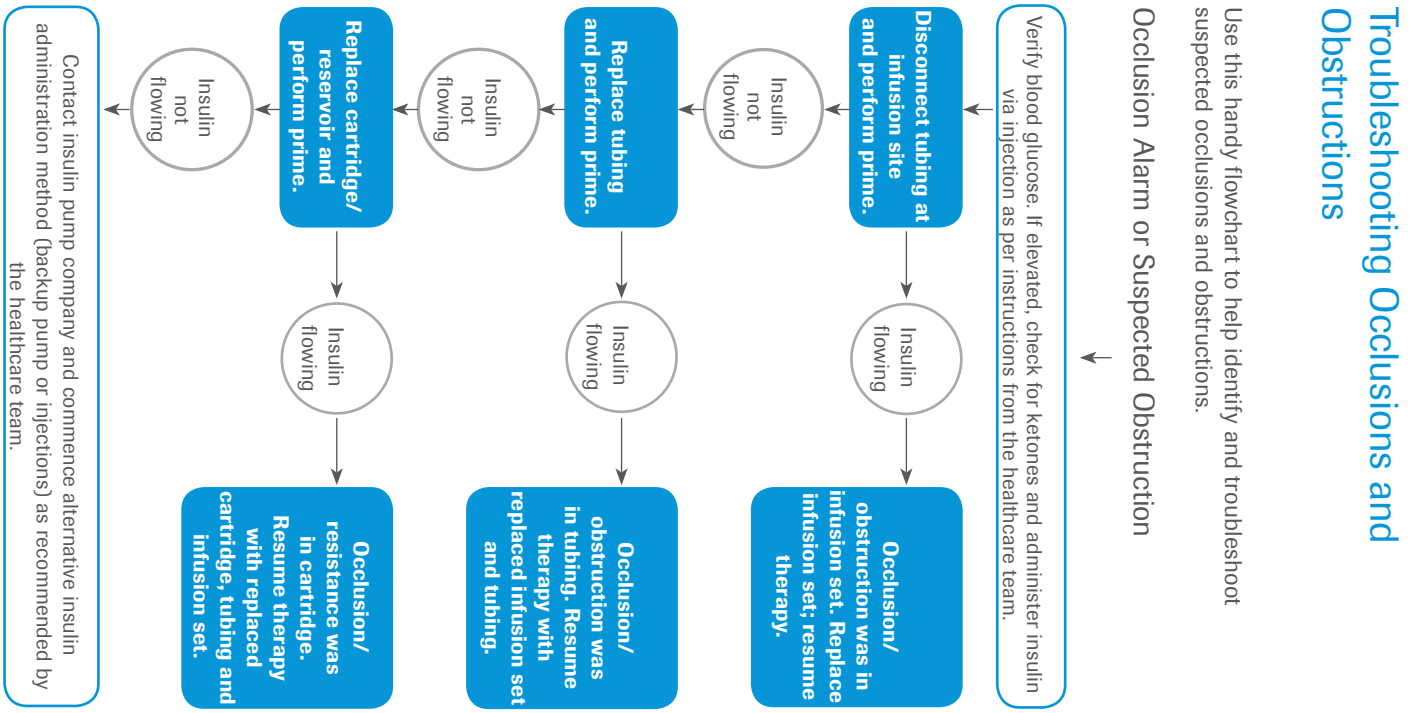
Here are some more troubleshooting tips to give patients:

- **If two unexplained high blood glucose readings occur in a row:** Make sure the set was primed correctly and luer-lock twisted tight. If there is doubt about whether this process was completed properly, change the infusion set and start over. If primed correctly, check to make sure the set is not dislodged and the adhesive is not wet. If you're connected and primed properly but still experience unexplained high readings, take a correction bolus and check blood glucose levels in two hours. If blood glucose levels have not been corrected, change the infusion set and check blood glucose again in two hours.
- **If there is blood in the tubing:** NEVER try to prime or bolus through an occlusion or blood area, change the infusion set immediately and move to a different site on the body. If blood is found in the tubing, change the infusion set and the tubing and move to a different site on the body. Note: If you are keeping the same insulin cartridge but changing the tubing, the new tubing may introduce air bubbles that will need to be primed out. See "If there is air in the tubing" below.
- **If there is air in the tubing:** Check to make sure the infusion set is clicked in or connected to the tubing and the pump. If it is and air bubbles are still in the tubing, disconnect the tubing at the infusion site, prime the air out, and reconnect the tubing. Filling the cartridge with room temperature insulin and checking the tubing for bubbles before connecting can help prevent this issue in the future.
- **If there are leaks in the tubing or at the luer-lock connection, an insulin smell is noticeable or the tubing has been used for longer than recommended:** Change the tubing and prime according to the set's instructions.

Troubleshooting Occlusions and Obstructions

Use this handy flowchart to help identify and troubleshoot suspected occlusions and obstructions.

Occlusion Alarm or Suspected Obstruction



Important Things to Remember

Check the infusion set every three hours (such as during bathroom breaks) and look for:

- Blood
- Full tape adherence
- Wet dressing
- Red or irritated skin

When to change an infusion set:

- Steel cannula sets—every one to two days
- Soft cannula sets—every two to three days
- If two unexplained high blood glucose readings occur in a row
- If skin is itchy, red or irritated
- If an occlusion alarm occurs
- If there is blood in the cannula or the tubing

Tricks to successful infusion site management:

- Always use clean hands when handling infusion sets and infusion sites
- Change set often and know when to change
- Practice proper site rotation and placement
- Always confirm insulin flow
- Plan placement around clothing options
- Know when to disconnect
- Talk to a healthcare provider about replacement insulin when disconnected
- Tuck tubing into clothing

Glossary

Basal delivery: A continuous 24-hour delivery of insulin that matches background insulin needs.

Basal rate: The rate at which a continuous, low level of insulin is delivered.

Blood glucose: The main sugar found in the blood and the body's main source of energy. Also called blood sugar.

Blood glucose level: The amount of glucose in a given amount of blood. It is noted in milligrams per deciliter (mg/dL) or millimoles per liter (mmol/L).

Blood glucose meter: A small, portable machine used by people with diabetes to check their blood glucose levels. After pricking the skin with a lancet, one places a drop of blood on a test strip in the machine. The meter (or monitor) displays the blood glucose level as a number on the meter's digital display.

Blood glucose monitoring: Checking blood glucose levels on a regular basis in order to manage diabetes. A blood glucose meter (using blood glucose test strips that change color when touched by a blood sample) is needed for frequent blood glucose monitoring.

Blood sugar: See *blood glucose*.

Bolus: A dose of insulin delivered quickly to match carbohydrate intake or to bring a high blood glucose back to normal.

Cannula: The soft and flexible or stainless steel tube through which insulin is delivered into the skin.

Certified diabetes educator (CDE): A healthcare professional with expertise in diabetes education who has met eligibility requirements and successfully completed a certification exam. See *diabetes educator*.

Co-extruded: A smaller tube within a tube.

Complications: Harmful effects of diabetes, such as damage to the eyes, heart, blood vessels, nervous system, teeth and gums, feet, skin or kidneys. Studies show that keeping blood glucose, blood pressure and low-density lipoprotein (LDL) cholesterol levels close to normal can help prevent or delay these problems.

Diabetes educator: A healthcare professional who teaches people with diabetes how to manage their condition. Some diabetes educators are *certified diabetes educators*. Diabetes educators are found in hospitals, physician offices, managed care organizations, home healthcare and other settings.

Diabetic ketoacidosis (DKA): An emergency condition in which extremely high blood glucose levels, along with a severe lack of insulin, result in the breakdown of body fat for energy and an accumulation of ketones in the blood and urine. Signs of DKA are nausea and vomiting, stomach pain, fruity breath odor and rapid breathing. Untreated DKA can lead to coma and death.

DKA: See *diabetic ketoacidosis*.

Extended bolus: A bolus of insulin given over an extended period of time.

Gestational diabetes mellitus (GDM): A type of diabetes mellitus that develops only during pregnancy and usually disappears upon delivery, but increases the risk that the mother will develop diabetes later. GDM is managed with meal planning, activity and, in some cases, insulin.

Glucagon: A hormone produced by the alpha cells in the pancreas that raises blood glucose. An injectable form of glucagon, available by prescription, may be used to treat severe hypoglycemia.

Glucose: One of the simplest forms of sugar.

Glucose tablets: Chewable tablets made of pure glucose used for treating hypoglycemia.

Hyperglycemia: A condition in which the blood contains an abnormally high level of glucose, characteristic of diabetes mellitus.

Hypoglycemia: Too low a level of glucose (sugar) in the blood. This occurs when a person with diabetes has injected too much insulin, eaten too little food or has exercised without extra food. A person with hypoglycemia may feel nervous, shaky, weak or sweaty and have a headache, blurred vision and hunger. Hypoglycemia can be treated by consuming a carbohydrate-rich food, such as a glucose tablet or juice. It may also be treated with an injection of glucagon if the person is unconscious or unable to swallow. Also called an insulin reaction.

Infusion set: A device that carries insulin from the insulin pump to the body.

Infusion site rotation: Changing the sites on the body where insulin is infused or injected.

Injection: Inserting liquid medication or nutrients into the body with a syringe. A person with diabetes may use short needles or pinch the skin and inject at an angle to avoid an intramuscular injection of insulin.

Insertion device: A spring-loaded device into which an infusion set's head set fits and which injects the cannula into the skin with the press of a button.

Insulin: A hormone secreted by the beta cells of the islets of Langerhans in the pancreas. Needed by many cells to use glucose for energy.

Insulin adjustment: A change in the amount of insulin a person with diabetes takes based on factors such as food intake, activity and blood glucose levels.

Insulin pump: A small, computerized device about the size of a pager that can be programmed to send a steady stream of insulin into the bloodstream as basal insulin, as well as larger amounts prior to meals as boluses. It replaces insulin injections.

Introducer needle: A needle that extends through the soft cannula and punctures the skin, thus "introducing" the cannula into the tissue. The needle is removed after the set has been inserted, leaving the cannula in place.

Ketoacidosis: A very serious condition in which the body does not have enough insulin. An excess release of free fatty acids causes high levels of ketones to accumulate in the blood and urine. Also see *diabetic ketoacidosis*.

Ketone: A chemical produced when there is a shortage of insulin in the blood and the body breaks down body fat for energy. High levels of ketones can lead to diabetic ketoacidosis and coma. Sometimes referred to as ketone bodies.

Ketosis: A ketone buildup in the body that may lead to diabetic ketoacidosis. Signs of ketosis are nausea, vomiting and stomach pain.

Lipohypertrophy: An overgrowth of fatty tissue caused by not changing infusion sites.

Low blood sugar: See *hypoglycemia*.

Luer-lock connector: The fitting on the end of the infusion set tubing and on the insulin pump cartridge that allows them to be connected, or locked, together securely.

Needle phobia: Fear of needles and inability to give oneself an injection.

Occlusion: Blockage.

Postprandial blood glucose: The blood glucose level taken one to two hours after eating.

Preprandial blood glucose: The blood glucose level taken before eating.

Proprietary infusion set: An infusion set made to fit a specific pump; doesn't fit other pumps or devices.

Pump: See *insulin pump*.

Sandwich technique: Placement of a dressing under and over an infusion set.

Self-management: In diabetes, the ongoing process of managing diabetes. Includes meal planning, planned physical activity, blood glucose monitoring, taking diabetes medicines, handling episodes of illness, dealing with low and high blood glucose, managing diabetes when traveling, and more.

Sharps container: A container for disposal of used needles and syringes or other sharp objects; often made of hard plastic so that needles cannot poke through.

Staph carrier: Someone prone to infection with staphylococcus bacteria.

Subcutaneous infusion: Putting a fluid (e.g., insulin) into the tissue just under the skin with an infusion set.

Syringe: A device used to inject medications (e.g., insulin) or other liquids into body tissues. The syringe for insulin has a hollow plastic tube with a plunger inside and a needle on the end.

References

1. Liebl A, Klinge A, Buhr A. Clinical benefits of automatic insertion of infusion sets in CSII. Presented at: 26th Workshop of the Study Group on Artificial Insulin Delivery, Pancreas and Islet Transplantation (AIDPIT) of the European Association for the Study of Diabetes (EASD) and 1st European Diabetes Technology and Transplantation Meeting; Feb. 4-6, 2007; Montpellier, France.
2. Bolderman K. *Putting Your Patients on the Pump*. 1st ed. Alexandria, VA: American Diabetes Association; 2002.
3. Buse J. What should be the frequency of rotation of skin sites for insulin injections? *Diabetes & Endocrinology*. Ask the Expert. Medscape Diabetes and Endocrinology. 3(2): 2001. www.medscape.com/viewarticle/412395.
4. Eising S, Zass R, Heise T, Koch H, Harms E. Impact of lipohypertrophy on metabolic control in paediatric patients with diabetes mellitus type 1. *Diabetologia*. 2002; 45(suppl 2): A283.
5. Hauner H, Stockamp B, Haastert B. Prevalence of lipohypertrophy in insulin treated diabetic patients and predisposing factors. *Experimental & Clinical Endocrinology and Diabetes*. 1996; 104(2): 106-110.
6. Walsh J, Roberts R. *Pumping Insulin*. 4th ed. San Diego, CA: Torrey Pines Press; 2006.
7. Wolpert H, ed. *Smart Pumping for People with Diabetes*. 1st ed. Alexandria, VA: American Diabetes Association; 2002.

Finding an Infusion Set That Fits

Choosing the right infusion set is a vital, but sometimes overlooked, component of successful insulin pump therapy. Since patients wear an infusion set every day, it plays a big part in their therapy and their lives.

Using the wrong type of infusion set can leave patients discouraged and may have adverse effects on all aspects of their pump therapy, including HbA1c levels.

Selecting the right solution:

To ensure their infusion set meets their specific requirements, your patients must consider the following criteria:

- **Needle length** – shorter lengths are preferred for children.
- **Angle of insertion** – directly influenced by body mass.
- **Cannula type** – soft cannula is preferred for those with an active lifestyle.
- **Preferred insertion method** – manually or using an insertion device.
- **Preferred infusion site** – can affect the choice of insertion method and tubing length.

Wide Variety. More Advantages.

Other factors that may affect your patients' choice of infusion set relate directly to using an insulin pump, for example, occlusion. ACCU–CHEK infusion sets are designed to make dealing with such factors an easier task:

- **Wide variety** – a variety of cannula types, insertion angles and tubing lengths accommodate most lifestyles, activity levels, and body types.
- **Simple handling** – easy-to-use functions offer safety and comfort – and can help those with dexterity or visual issues.
- **Less painful insertion** – thanks to our range of ultra-fine insertion needles.
- **Co-extruded tubing** – prevents kinking and less insulin is needed to prime set.
- **Less waste of insulin** – ACCU–CHEK tubing can be used for up to six days, reducing insulin waste.
- **Skin friendly** – patients can choose from a range of hypoallergenic plasters to suit their skin sensitivity.
- **Optimal absorption** – sets are designed for placement in a variety of sites and depths for consistent insulin absorption.

- **Modular packaging system** – cannula can be bought separately from tubing sets, allowing insulin pump users to purchase only what they need.
- **Standard luer–lock connection** – ACCU–CHEK infusion sets work with most insulin pumps on the market.

Innovative solutions to suit all.

Being in constant dialogue with our customers gives us a better understanding of the challenges you face. This makes us more determined to continuously improve our range of infusion sets and provide a broad variety of solutions to meet your patients' needs.

To find out more information about all ACCU-CHEK products, or the ways Roche works to improve diabetes therapy, please call us or visit us online.

Experience what's possible.

accu-chekinsulinpumps.com

Infusion Set Basics and Site Management DVD

Tips for a safe and successful experience

This video is designed to explain the basics of infusion sets, their usage and how they fit into daily life with diabetes. It also features demonstrations of preparing, inserting and removing an infusion set, as well as real-life perspectives from pump wearers.

Distributed by:
Roche Insulin Delivery Systems Inc.
11800 Exit 5 Parkway, Suite 120
Fishers, IN 46037
Phone: 1-800-280-7801
Fax: 1-888-810-0758
For technical assistance, call ACCU-CHEK
Customer Care at 1-800-688-4578.

Canadian address:
2425 Matheson Blvd. East, Suite 735
Missassauga, ON L4W 5K4

accu-chek.com

ACCU-CHEK®