⚠ Hand-washing

Theory

Hand-washing is the single-most important procedure for preventing the spread of infections. It is underperformed in frequency and quality.

Hands should be washed before every episode of care that involves direct contact with a patient's skin, their food, invasive devices, or dressings, and after any activity or contact that could result in hands becoming contaminated, such as using community computers to enter data.

Alcohol sanitizers can also be regularly used when entering or leaving a patient care area and before and after examining patients.

Equipment

- Soap and alcohol gel
- Disposable paper towels
- Moisturizer (if required)

Procedure

If hands are not visibly soiled, hand-sanitizing with alcohol-cleansing agents may be as if not more effective than hand-washing.

When required to wash our hands, we should use soap and warm water. Those parts often missed are the tips of fingers, thumbs, and between the fingers.

The following routine is advised (Fig. 18.1):

- First, rub hands palm to palm (Fig. 18.1a).
- Rub right palm over the left dorsum.
- Rub left palm over the right dorsum.
- Wash palm to palm with the fingers interlaced (Fig. 18.1b).
- Wash the backs of the fingers with opposing palms, with fingers interlocked (Fig. 18.1c).
- Perform rotational rubbing of the right thumb clasped with the left fist (Fig. 18.1d).
- Perform rotational rubbing of the left thumb clasped with the right fist.
- Wash the right palm with rotational rubbing using fingers of left hand.
- Wash the left palm with rotational rubbing using the finger of the right hand (Fig. 18.1e).
- Wash the space between the thumbs and first fingers by interlocking them and rubbing together (Fig. 18.1f).
- Rinse away all soap and pat dry using disposable paper towels.
- Apply moisturizer to protect the skin from the drying effects of regular washing.

▶ Hints

- Keep nails short, clean, and polish free.
- Avoid wearing wristwatches and jewelry, especially rings with ridges or stones.
- Any cuts or abrasions should be covered with waterproof dressing.

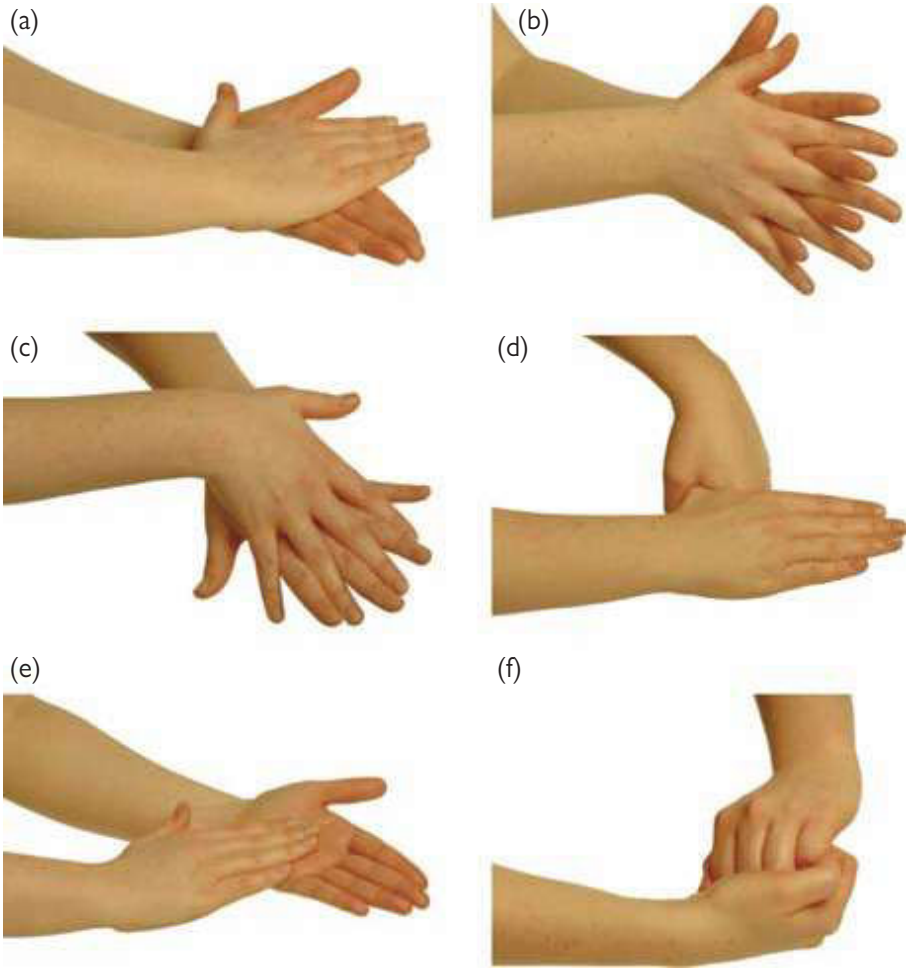

Fig. 18.1 The correct stages of hand-washing as described on previous page.

⚠ Injections

Theory

This is an important and routine procedure that is often carried out by nursing staff, although providers may be asked to administer medication at times. Good injection technique can make the experience for the patient relatively painless. Three commonly used routes of administration are subcutaneous (SC), intramuscular (IM), and intradermal (ID).

► Before gloving for any procedure, confirm the absence of latex allergy.

► Before attempting an injection, familiarize yourself with the operation of any syringe cover or guard device.

Equipment

- Syringe (size depends on injection)
- Needles: 25-gauge (G) for SC route; 21–23G for IM route
- Extra 21G needle for drawing up dose
- Alcohol swab
- Gloves
- Cotton
- Sharps container
- Medication for injecting
- Band-aid for covering injection site

Procedures

Subcutaneous injections

The SC route is used for a slow absorption of medication and is ideal for drugs such as insulin.

- Introduce yourself, confirm the identity of the patient, explain the procedure, and obtain verbal consent.
- Wash your hands and put on a pair of gloves.

► Always check that you have the correct drug and correct dose and that it is within the expiration date before injecting it.

- Draw up the medication using a 21G needle and double check the medication, dose, and expiration date.
- Expel any air in the syringe and replace with a 25G needle or other needle appropriate for the medication being injected.
- Clean the injection site with the alcohol swab.
- Pinch a fold of skin so as to lift the adipose tissue away from the underlying muscle.
- Insert the needle horizontally into the fold and draw back to ensure you are not in a vein.
- Inject the medication.
- Withdraw needle and apply cotton to the site to absorb any bleeding.

Suitable SC sites include the forearm, triceps area, and abdomen.

Intramuscular injections

IM injections are administered through the epidermis, dermis, and SC tissue into the muscle. They provide rapid systemic action and allow relatively large doses to be absorbed.

Suitable IM sites typically include the deltoid muscle, dorsogluteal site, ventrogluteal site, and lateral thigh or vastus lateralis muscle, depending on available muscle mass. A related method of IM injection, the Z-track method, is used for "sealing" the injection site to prevent staining from medications such is iron.

Remember to avoid sites of inflammation, swelling, infection, or skin lesions.

- Introduce yourself, confirm the identity of the patient, explain the procedure, and obtain verbal consent.
- Wash your hands and put on a pair of gloves.
- Always check that you have the correct drug and correct dose and that it is within the expiration date before injecting it.
- Draw up the medication using a 21G needle and have a colleague double check the medication, dose, and expiration date.
- Expel any air in the syringe and replace with a 25G needle or other needle appropriate for the medication being injected.
- Inspect the proposed site for adequate muscle mass.
- Clean the injection site with the alcohol swab.
- IM injections should be given at a 90^0 angle to ensure the needle reaches the muscle and to reduce pain.
- A good way to ensure accuracy and avoid a needle-stick injury is to rest the heel of the palm on the thumb of the nondominant hand.
- Pull the skin down or to one side at the intended site.
- Hold the syringe between the thumb and forefinger and insert the needle at full depth.
- Draw back on the syringe to ensure the needle is not in a vein.
- Slowly inject the medication.
- After needle insertion and injection, allow 10 seconds before removing the needle, to facilitate diffusion of the medication into the muscle.
- Withdraw the needle and wipe the area clean with cotton.

Intradermal injections

The ID route provides a local, rather than systemic, effect and is used primarily for diagnostic purposes, such as allergy or tuberculin testing.

This involves the same preliminary procedures as for IM injection except a 25G needle is inserted at a $10–15^0$ angle, bevel up, just under the epidermis.

Up to 0.5 mL is injected until a wheal appears on the skin surface—just as when creating a bleb of local anesthetic.

⚠ Venipuncture

Two methods exist: the common method of collecting blood directly into the tubes by Vacutainer®, and the traditional needle-and-syringe method.

Equipment

- Gloves
- Alcohol swabs
- Tourniquet
- Sticky tape
- Gauze or cotton ball
- Needle (try 21G first), a syringe, and blood collection bottle or:
- Vacutainer® tube, holder, and blood collection needle
- Don't forget a band-aid!

Procedure

Using a needle and syringe

- Introduce yourself, confirm the patient's identity, explain the procedure, and obtain verbal consent.
- The patient should be lying or sitting comfortably with the arm from which blood is to be taken resting on a pillow.
- Select a vein site—usually the antecubital fossa (see Fig. 18.2).
- Apply tourniquet proximal to the puncture site and recheck vein.
- Put on gloves and ask the patient to clench their fist a few times.
- Cleanse the area with an alcohol swab in spirals, inside to out.*
- Attach the needle to a syringe and unsheathe it.
- Use the thumb of your nondominant hand to gently anchor the skin just below the puncture site.

❗ Warn patient to expect a sharp scratch and to not move their arm.

- Insert the needle firmly through the skin, bevel up, at an angle of 20–40^0 over the vein.
- With experience, you will feel a slight give as the vein is entered. Blood will visibly enter the hub (plastic portion) of the needle (flashback).
- Carefully holding the needle in position, pull back on the plunger.
  - There are several ways of doing this. The authors favor holding the needle and syringe in the nondominant hand, once in place, and pulling back with the dominant hand.
- When enough blood is taken, release the tourniquet *before* removing the needle from the vein.
- Apply a clean cotton ball or folded gauze to the puncture site as the needle is withdrawn. Pressure should be applied for >1 minute. (Ask the patient to do this for you, if they are able.)
- Apply a band-aid to the site, and thank the patient.
- Vacuum blood tubes are filled by puncturing the rubber top with the needle and allowing the blood to enter the tube.
- Remember to label the tubes correctly, ideally at the patient's bedside, and dispose of sharps in a sharps bin.

* There is no solid evidence for benefit in using alcohol wipes unless there is *visible* dirt at the venipuncture site. However, their use is policy in most facilities and should be used accordingly.

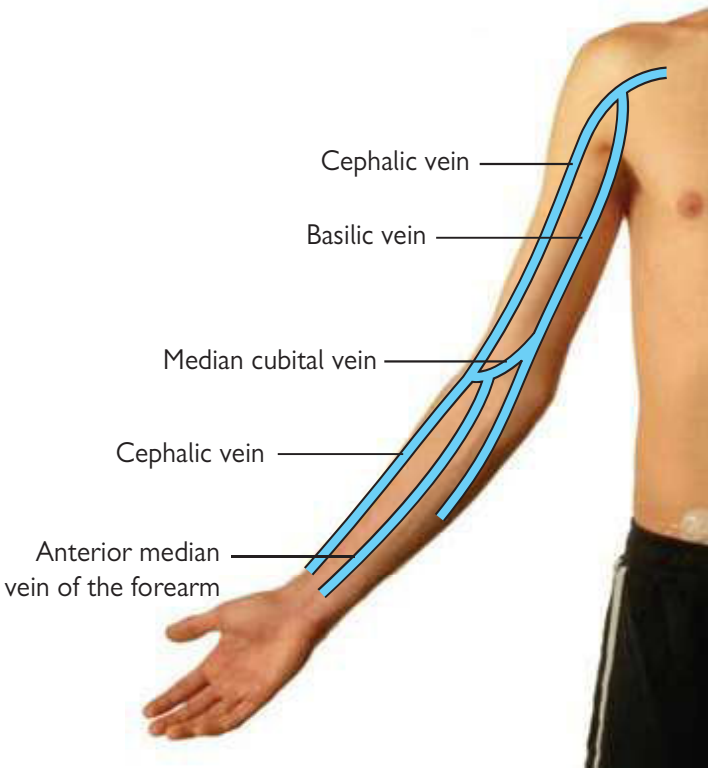

Fig. 18.2 Representation of peripheral veins of the upper limb.

Using a Vacutainer® system

Much of the procedure is the same as for using a needle and syringe.

- Vacutainer® needles are double-ended, one standard needle and one needle covered by a rubber sleeve.
- Attach a Vacutainer® holder over the covered needle (see Fig. 18.3).
- The needle is inserted into the vein as with a syringe, but no flashback will be visible.
- Once in place, the Vacutainer® tubes are attached to the needle directly by pushing them onto the covered needle using the tube holder.
- Allow enough blood to enter the tube (some tubes must be filled—check local laboratory guidance).
- Multiple tubes may be filled by removing and replacing tubes while carefully holding the needle in position.

Inappropriate sites for venipuncture

- Edematous areas
- Cellulitic areas
- Hematomas
- Phlebitis or thrombophlebitis
- Scarred areas
- Arm in which there is a transfusion or infusion
- Arm on the side of previous mastectomy
- Arms with AV fistulae or vascular grafts

Fig. 18.3 Vacutainer ® blood collection system, ready for use.

Hints

- If extraction of blood with the Vacutainer® proves difficult, it may be easier to switch to the needle-and-syringe technique, as this gives you more control over the flow of blood.
- Venipuncture can be performed at *any* peripheral vein. Inpatients from whom it is difficult to draw blood often have the blood taken from the back of their hands, feet, or legs.
- In difficult to reach places, it is often easier to use a butterfly needle. This is a smaller needle attached to a length of tubing that can be used with either technique. It allows for greater control of the needle.

Box 18.1 Taking blood from a central venous catheter

Theory

Central lines should only be used for taking blood if it is not possible to obtain a sample via the peripheral route. Do not risk catheter sepsis or a clotted line unless there are no alternatives!

Practicality

Central lines are frequently used for taking blood for assorted reasons. Avoidance of additional needle-sticks for patient comfort is a primary concern.

Blood culture requirements may preclude use of the central line for obtaining a sample. However, blood may need to be obtained from the central line and a peripheral site simultaneously to assist in differentiation of a source of sepsis.

In any case, caution must be observed to appropriately obtain a specimen from a port that may have been salinized or heparinized, and proper care of the port must be exercised after use of the port. Proper caution will decrease risk of catheter sepsis or a clotted line.

Facility policy will dictate what is done.

Equipment

- 3 x 10 mL syringes
- 0.9% isotonic or heparinized saline
- Chlorhexidine, povidone-iodine, or other recommended agent
- Gauze
- Sterile gloves
- Drape

Procedure

- Introduce yourself, confirm the identity of the patient, explain the procedure, and obtain verbal consent.
- Stop any infusions for at least 1 minute before sampling.
- Place the patient in a supine position.
- Ask the patient to turn their head away from the line site during the procedure.
- Drape the site in case of splash, and put on a pair of sterile gloves.
- Spray or paint the line with the chosen sanitizing agent.
- Clamp the line before removing the cap.
- Connect a 10 mL syringe to the line before unclamping.
- Withdraw 5–10 mL of blood, clamp the line, and remove syringe.
- Discard the blood.
- Connect a new 10 mL syringe to the line, unclamp it, and withdraw another 10 mL of blood.
- Clamp the line and remove the syringe (keep this sample).
- Fill a further syringe with saline and attach to the line.
- Unclamp the line, instill the saline, and clamp the line again.
- Remove the syringe and replace the cap.

⚠ Peripheral IV catheterization

Theory

Peripheral IV catheterization is a generic skill that most students should have learned early in their education. A thin tube line is inserted into a vein, allowing easy venous access that is used in many situations, including the administration of fluids and IV medication.

Equipment

- Gloves
- Alcohol swabs
- Tourniquet
- Saline for injection
- Sticky tape
- Gauze or cotton ball
- Catheter of appropriate size (see Box 18.2, Fig. 18.4)
- 5 mL syringe

Procedure

- Introduce yourself, confirm the patient's identity, explain the procedure, and obtain verbal consent.
- The patient should be lying or sitting comfortably with the arm in which the catheter is to be inserted resting on a pillow.
- Apply the tourniquet to the arm and identify a suitable vein.

❗ Often those veins that can be *felt* are more reliable than those that are *seen*.

The vein should be superficial and have a straight course for a few centimeters.

- Put on gloves and clean the overlying skin with the alcohol swab.
- Remove the catheter from its packaging.
- Ensure that the catheter is functioning properly by slightly withdrawing the needle and replacing it. Fold down the wings and open and close the port on the top.

❗ Warn patient to expect a sharp scratch and to not move their arm.

- Insert the catheter firmly through the skin, bevel up, at an angle of 20–40^0 over the vein.
- With experience, you will feel a slight give as the vein is entered. Blood will visibly enter the hub (plastic portion) of the catheter (flashback).
- Once the flashback is seen, hold the needle in place with one hand and slide the catheter off the needle—into the vein—with the other. Once the catheter is fully inserted, the needle should be sitting just within it, preventing blood from spilling.
- Release the tourniquet.
- Press over the vein at the tip of the catheter, remove the needle, and dispose of it safely in a sharps bin.
- Put the cap on the catheter and fix it in place with tape and the appropriate dressing.
- Draw up saline into the syringe and flush it through the catheter using the port on the top. Watch the vein—if the catheter is misplaced, the saline will enter the subcutaneous tissues, causing swelling.

▶ Don't forget to do this—it confirms that the catheter is working and clears it of blood that would form a clot.

Hints

- Try to avoid the antecubital fossa. Although this is often the easiest place to see and feel a vein, catheters at that site can become

Box 18.2 Sizing catheters

Like needles, catheters are color-coded according to size. Each is given a gauge (G), which has an inverse correlation to the external diameter. Color-coding is standardized across manufacturers.

The standard-size catheter is green, or 18G, but for most hospital patients, a pink, or 20G, cannula will suffice. Even blue catheters are adequate in most circumstances unless fast flows of fluid are required.

Gauge	External diameter (mm)	Length (mm)	Approximate maximum flow rate (mL/min)	Color
14G	2.1	45	290	Orange
16G	1.7	45	172	Gray
18G	1.3	45	76	Green
20G	1.0	33	54	Pink
22G	0.8	25	25	Blue

Fig. 18.4 A selection of standard IV catheters.

kinked and blocked as well as cause pain for the patient on bending the arm.

- Avoid an arm with a fistula or AV shunt.
- Bring a selection of different-sized catheters to the bedside, allowing you to choose a smaller gauge if you experience problems.
- Don't be afraid to ask for assistance from nursing or auxiliary staff if the patient is likely to move their arm during the procedure.

⚠ Setting up an infusion

Theory

Fluid therapy is one of the core skills for nurses. While it is usually the nursing staff that sets up an IV infusion, providers should nevertheless be competent at this technique.

Equipment

- Gloves
- An appropriate fluid bag
- Tubing (infusion) set
- IV (standard) pole
- Infusion pump, if required

Procedure

IV infusions require IV access—see 🕮 p. 522. Check the fluid in the bag and fluid prescription chart.

- Ask a colleague to double-check the prescription and the fluid and sign their name on the chart.
- Open the fluid bag and tubing set, which come in sterile packaging.
- Unwind the tubing set and close the adjustable valve.
- Remove the sterile cover from the bag outlet and from the sharp end of the tubing set (see Fig. 18.5).
- Using a lot of force, push the tubing set end into the bag outlet.
- Invert the bag and hang it on a stand.
- Squeeze the drip chamber to half fill it with fluid.
- Partially open the valve to allow the drip to run, and watch fluid run through to the end (it might be best to hold the free end over a sink in case of spills).
- If bubbles appear, try tapping or flicking the tube.
- Once the tubing is filled with liquid, connect it to the catheter.
- Adjust the valve and watch the drips in the chamber.
- Adjust the drip rate according to the prescription (see Box 18.3).

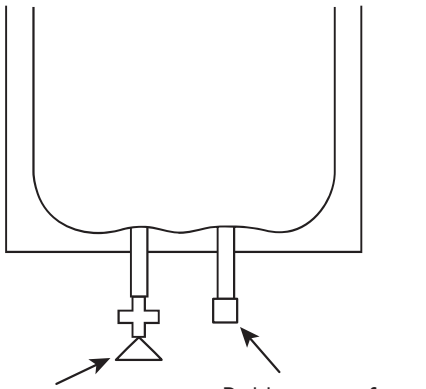

Fig. 18.5 Diagrammatic representation of the base of a fluid bag and the port in which the tubing set should be inserted.

Box 18.3 Drip rate

Most infusions tend to be given with electronic devices that pump the fluid in at the prescribed rate. However, it is still important that healthcare professionals be able to set up a drip at the correct flow rate manually.

Using a standard tubing set, clear fluids will form drips of about 0.05 mL—that is, there will be approximately 20 drips/mL. You can then calculate the number of drips per minute for a given infusion rate.

Infusion and drip rates

Prescription number of hours per liter of fluid	Infusion rate (mL/hr)	Infusion rate (mL/min)	Drip rate (drips/min)
1	1000	16	320
2	500	8	160
4	250	4	80
6	166	3	60
8	125	2	40
10	100	1.6	32
12	83	1.4	28
24	42	0.7	14