

Intravenous infusions (IVs)



Introduction to IVs

Direct administration of fluids into the vein of choice

SC (subcutaneous) or IM (intramuscular) injections are limited to 3 mL since larger quantities lead to local problems

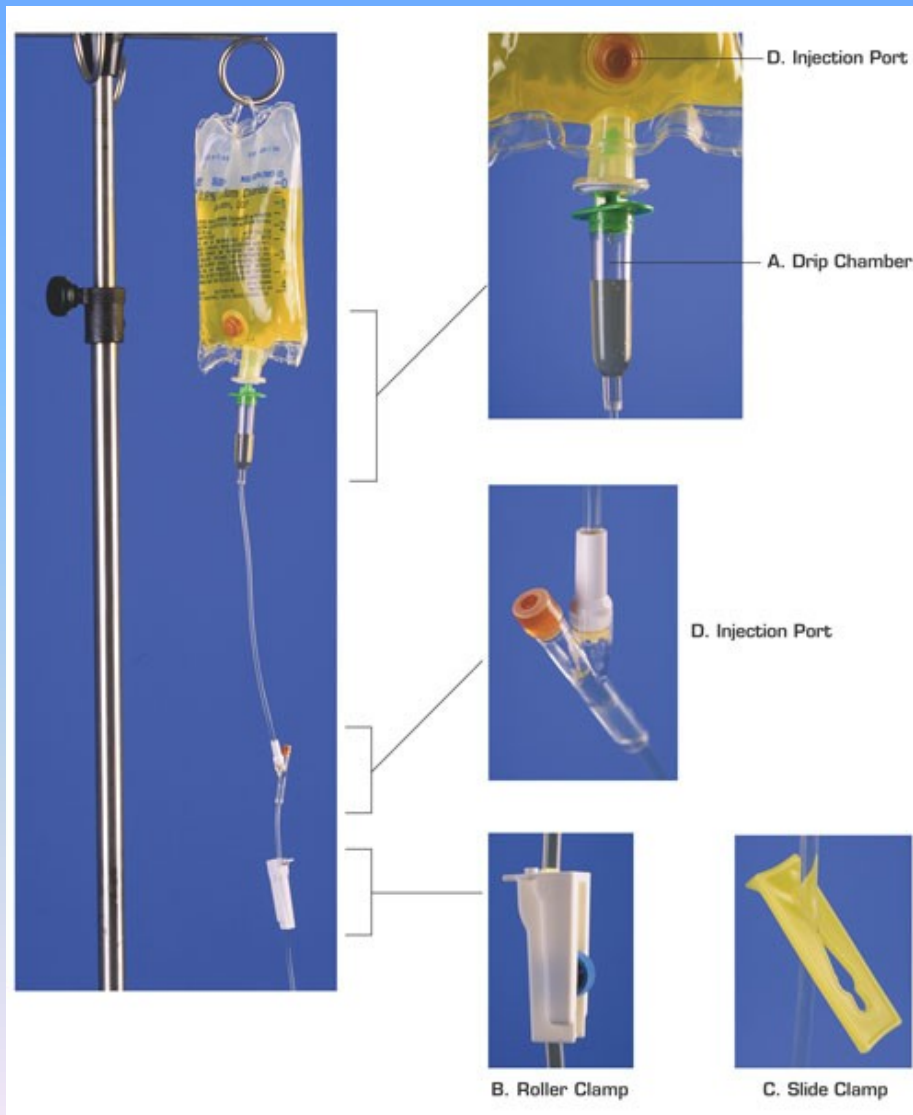
Only limit on IV is the total body fluid content, since total fluid intake should be **35-50 mL / kg body weight / day is acceptable** (in 100kg man – 3.5 – 5L per day!!)

IVs are given when we need to **give a lot of fluid**, or if we need to **dilute a medication** a lot to reduce irritation

Usually **given over longer periods of time** (15 minutes to several hours) in contrast to SC and IM which give entire dose instantly

IV administration allows **fastest method of administration** (bioavailability / bioequivalence is high) because it goes directly into the blood, so may be used for **rapid onset of medication**

Basic IV setup



IVs are usually administered by bags of fluid that come premixed. The standard sizes range from 50 mL to 1000 mL.

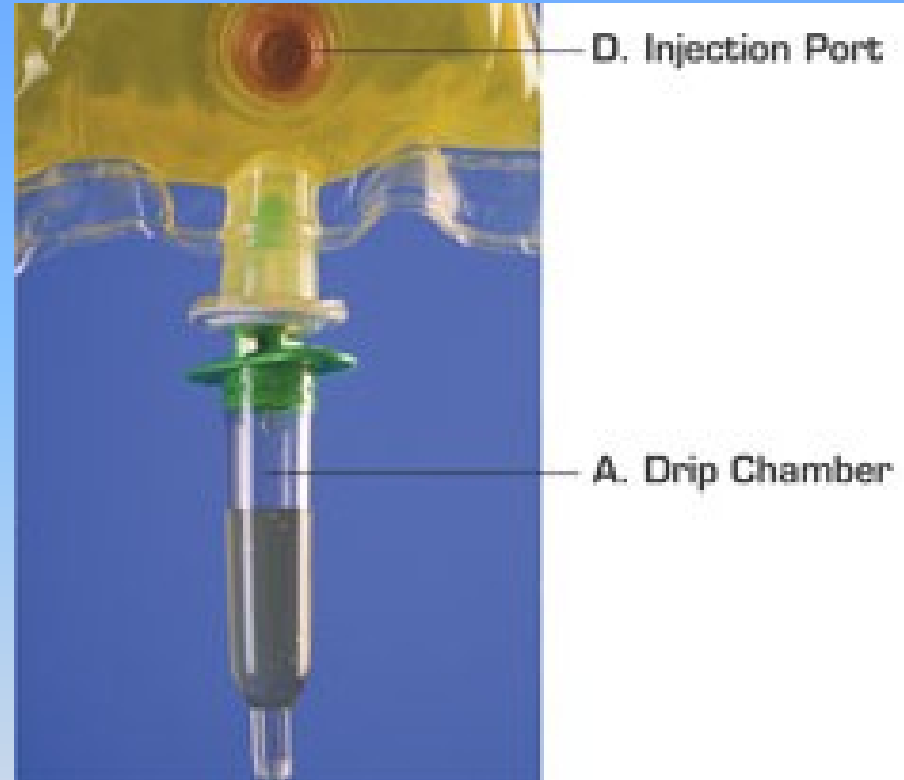
The bag is hung from an **IV pole**, and **IV tubing** is attached to the bottom of the bag.

The tubing has several important parts:

- a) **Drip chamber**
- b) **Roller clamp**
- c) **Side clamp**
- d) **Injection port**

a) Drip chamber

- Located just below the bag
- Used to **visualise the fluid dripping into the tubing from the bag**
- This is where we **measure the speed of a manual IV setup** – we look at the chamber and count the number of drops per minute
- The **drip chamber should always be about half full.**



- If it is too full, we cannot see the drops, so cannot count them
- If it is not full enough, then this will allow air to get into the IV tubing and therefore into the patient's circulatory system, which can be very dangerous, blocking a blood vessel (venous air embolism – VAE), or stopping the heart

b) Roller clamp

- This is what we use to **control the rate at which the IV fluid infuses**
- If we **roll it one way, it squeezes the tubing** more tightly, making it more narrow and therefore **slowing the fluid flow** through it
- If we **roll it the other way, it loosens its pinching** of the IV tubing, making the tubing less narrow, **increasing the fluid flow** through it
- All **roller clamps on a set of IV tubing should be closed before we attach a bag of IV fluid** the top of the tubing, ensuring no air gets into the tubing
- **Every medication is ordered at a specific infusion rate (or flow rate)**



B. Roller Clamp

c) Side clamp

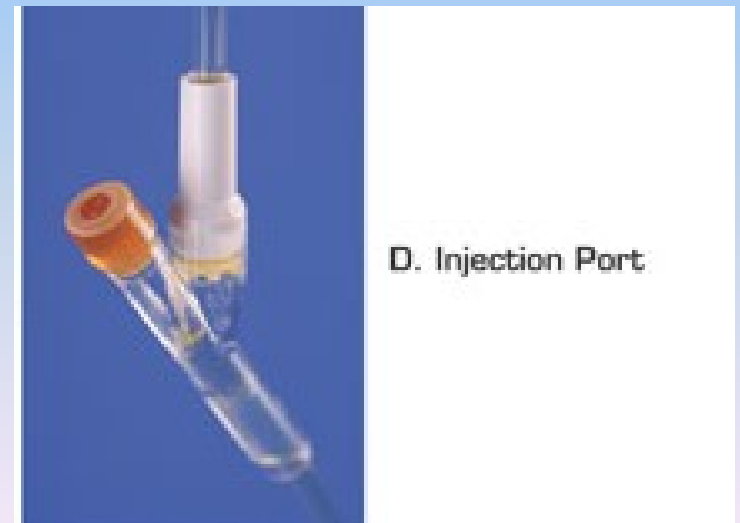
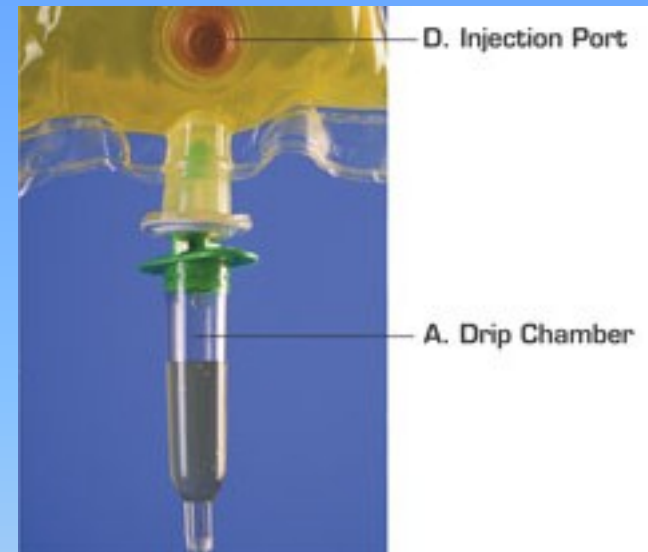
- This is used when we want to **completely stop the IV from flowing**, without having to adjust the roller clamp
- It is useful for momentary breaks in the flow, without having to reset the flow rate again by readjusting the roller clamp all over again
- It works by **completely pinching off the IV tubing** when we slide the tube through the **narrowest part of the clamp**



C. Slide Clamp

d) Injection port

- This is the place where **medicine or fluids other than those in the current IV bag can be injected** so that they will infuse into the patient's vein through the IV tubing
- Here we can see 2 ports, **one in the bag** and **one below the drip chamber**, there is also usually **one where the needle goes into the patient's vein**
- The injection port **on the IV bag is used if we want to mix some kind of medication with the fluid in the bag** (need to be compatible)
- If we want to **inject medication or a second kind of IV fluid that we've already attached**, then we will use one of the ports that are **located below the drip chamber**

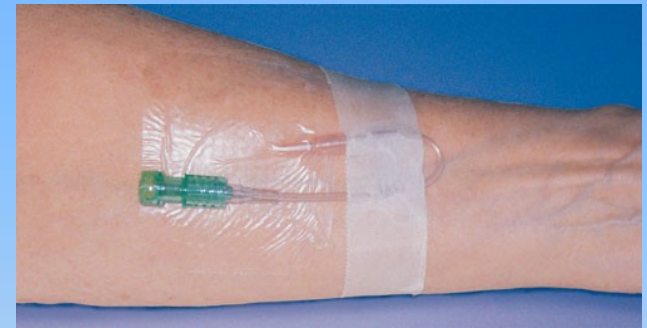


Height of the IV bag

- IV infusion works because of **GRAVITY** – pushes fluid down through tubing into the vein
- The **higher the bag is hung**, the **greater the gravitational pressure** on the IV fluid **to go downward through the tubing**, if the **bag is not high enough**, there will **not be enough pressure to force fluid into the vein**
- All **IV bags must be hung above the patient's heart** in order for there to be enough pressure for the fluid to infuse – **usually 3 feet** above an adult patient's heart
- **Change in the movement** of the patient will result in **changes in the infusion rate**, so **constant monitoring** is required – **usually every hour** and after any major change in position
- Sometimes **needle can be dislodged** from the vein so that the fluid is infusing into the tissue – **infiltration** – eventually IV will stop due to a higher pressure in the tissue compared with the IV tube. Look for **swelling, coolness** and **pain**

How is IV attached to patient

Can attach a peripheral line (to limb) – these can only be used for a short period, usually 3 days due to risk of infection, so if it is required for longer then it is standard procedure to move the injection site to a new location every 3 days



A central line is an IV attached to a vein in the chest – usually through the chest wall, or neck veins, but it is also possible to insert the cannula into a peripheral vein and move the tip of the cannula slowly upward until it reaches a central vein

Continuous vs Intermittent

- IV medication can be given **continuously**, or **intermittently**
- A patient who requires **continuous infusion** has a **constant IV setup**
- A patient who only **requires intermittent IVs** have a **cannula** setup to them continuously, which is independent of the IV infusion equipment
- The cannula has an **injection port** attached to it's end called an infusion port adapter (sometimes referred to as a heplock or saline lock/port)
- Cannula should be **flushed** since it can become blocked by clotted blood – can use **2mL saline** or **2mL heparin** (concentration of 100U/mL) **every 6-8 hours**

FOR MORE INFORMATION ON CANNULAS, SEE LECTURE ON INTRAVENOUS CANNULATION

Secondary IV or IV Piggyback

- If patient is receiving continuous IV fluids and/or medication and in addition must receive a second kind of **intermittent infusion**, or if a patient's **current IV infusion must be interrupted** in order to **administer a second IV medication or fluid that is more pressing**, then we need to hang a secondary IV for the patient
- **Secondary IV = IV Piggyback = IVPB** = Second IV bag hung next to first and enters patient **through first set of IV tubing** through an **injection port below the drip chamber**
- Usually used for **medications which have smaller volumes than the primary IV (50 – 250 mL)**. Is also, usually given intermittently
- Since we want the **secondary infusion** to infuse faster, we hang it **higher** than the first bag

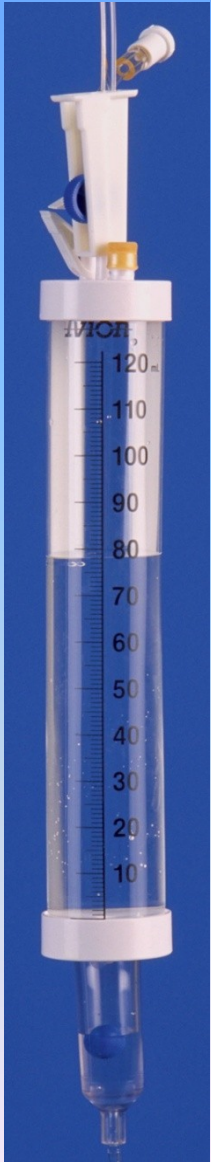


IV Push or Bolus

- Sometimes we want to give an injection by intravenous administration, but want to give a **small volume all at once**. This could be for a few reasons: could be **larger than 3mL**; It will be **better absorbed**; avoid the **first pass effect**.
- We can **give the IV injection all at once by inserting a syringe into one of the injection ports** and this is called an **IV push** or **Bolus**
- It can be **given alongside a continuous infusion** or can be **given into a heparin lock** which has previously been setup



Smaller volume IV doses



- If the volume of fluid we wish to infuse is relatively small (E.g. For an infant or small child, then we need to **use a method where small volumes can be controlled.**
- We use a **volume-controlled burette** (allows measurement of **120 mL in graduations of 1mL**
- Still has **drip chamber, roller clamp** (on top so we can hang an IV bag above it, to mix a single dose) and **injection port** at the top



Medication vial ports

- Most medications are mixed with IV fluids by injecting them directly into a premixed IV fluid bag
- Some drug manufacturers also produce special IV bags which contain a **medication vial port**, which **allows specially shaped vials of powdered medication to be attached directly to the top of a special IV fluid bag**
- E.g. Powdered Vancomycin hydrochloride into 100 mL of 0.9% Sodium Chloride



Electronic infusion devices

• It is becoming more and more common to for many IV setups in hospitals to be implemented using **machines which control the infusion rate on their own**, only requiring the practitioner to **enter infusion rate in mL/hr**. There are 3 common kinds of electronic infusion devices:

1. **Volumetric Pumps** – **force fluid into the vein under pressure** and **against resistance**, but **DO NOT depend upon gravity**. **Rates** need to be **monitored regularly**. Some have an inbuilt alarm when rate is not being maintained. Also we need to **monitor regularly for infiltration**



Electronic infusion devices

2. **Syringe pumps** - these are used for **infusion of a very small amount of fluid over an extended period of time**, but we need to control the speed that the plunger is depressed. This is **difficult to conduct manually**, therefore syringe pumps are very useful. **Some medications cannot be diluted without losing their efficacy**, so these kinds of medications may be given using a syringe pump



Electronic infusion devices

3. **Patient controlled analgesia** – allows **patient to choose when they can take their IV medication, based on how they feel**. The device includes a button which the patient can press whenever they feel in need of pain relief, which triggers the machine to dispense the **pre-programmed dose of medication**. The machine is also pre-programmed to “**time-out**” so that the **patient cannot overdose**. Some machines record the **frequency with which the patient presses the button**, so that the practitioner is able to **monitor how often the patient is in pain**



IV Fluids

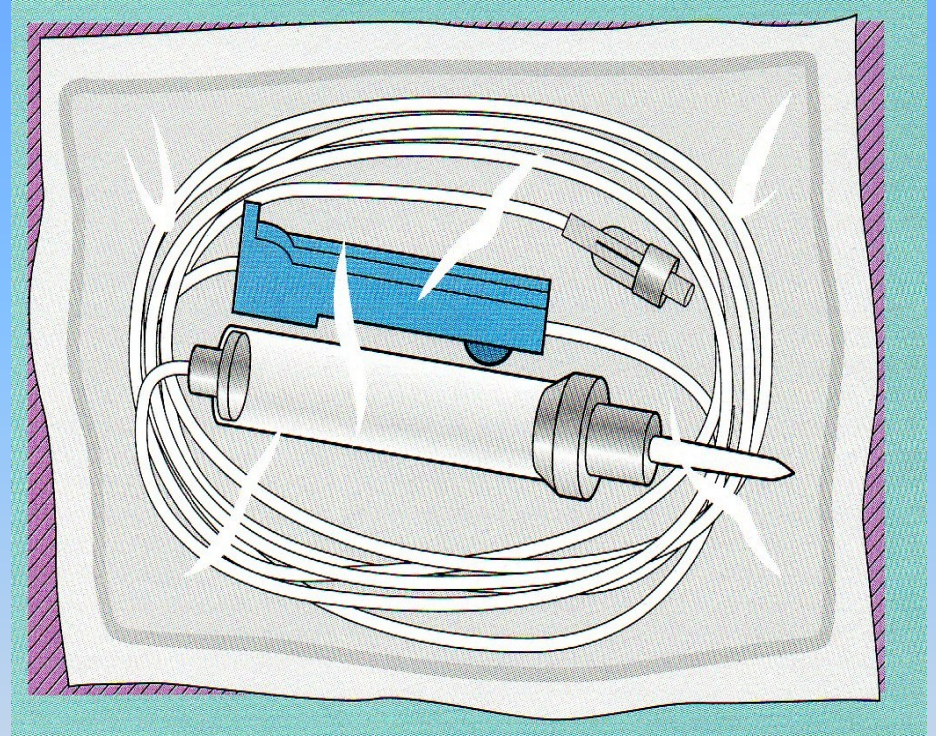
- There are many different types of IV fluids, and often these fluids are expressed using abbreviations when they are written into the drug order form.
- Any number that appear in an IV abbreviation indicate percentages. E.g. D5W is 5% dextrose in water and D2.5NS is 2.5% dextrose in 0.9% salt in water
- Remember that percentages in IV fluids and other medications actually represent number of grams in 100mL of diluent, so D2.5NS is 2.5g dextrose per 100mL normal saline, which is actually 2.5g dextrose and 0.9g salt per 100mL water

Priming an IV infusion set

- Before fluid can be given via the IV route the infusion set must be primed. This involves running the fluid to be infused through the set, to prevent an air embolus. Asepsis should be maintained during the procedure to prevent any internal or exposed areas being contaminated
- There are various types of infusion sets available:
 - Large-bore sets which have large internal diameter (reduced drops per mL ratio) so that there can be fast flow rate
 - Smaller-bore sets offer larger drops per mL value so can be used to administer crystalloid and diluted drug infusions
- Both types of devices are gravity dependent and flow is controlled by means of the roller clamp
- Only recommended sets may be used with electronic volumetric infusion devices
- All sets have a trocar and a luer lock connector
- Packaging should be sterile, intact and within expiry date

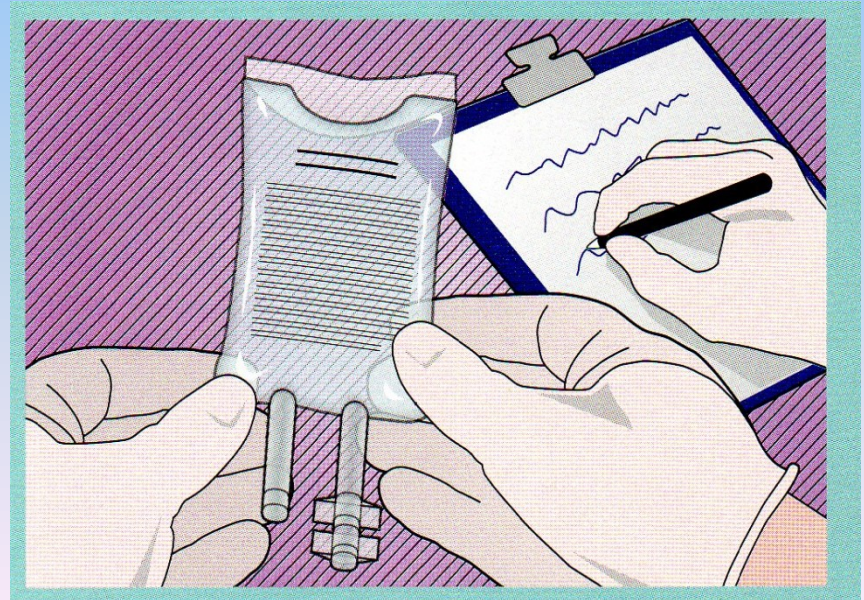
Equipment required

- Fluid to be infused
- Administration set
- Clean gloves / apron
- Receptacle for any discarded fluid
- Drip stand
- Alcohol swab
- Air inlet if using glass or rigid containers)



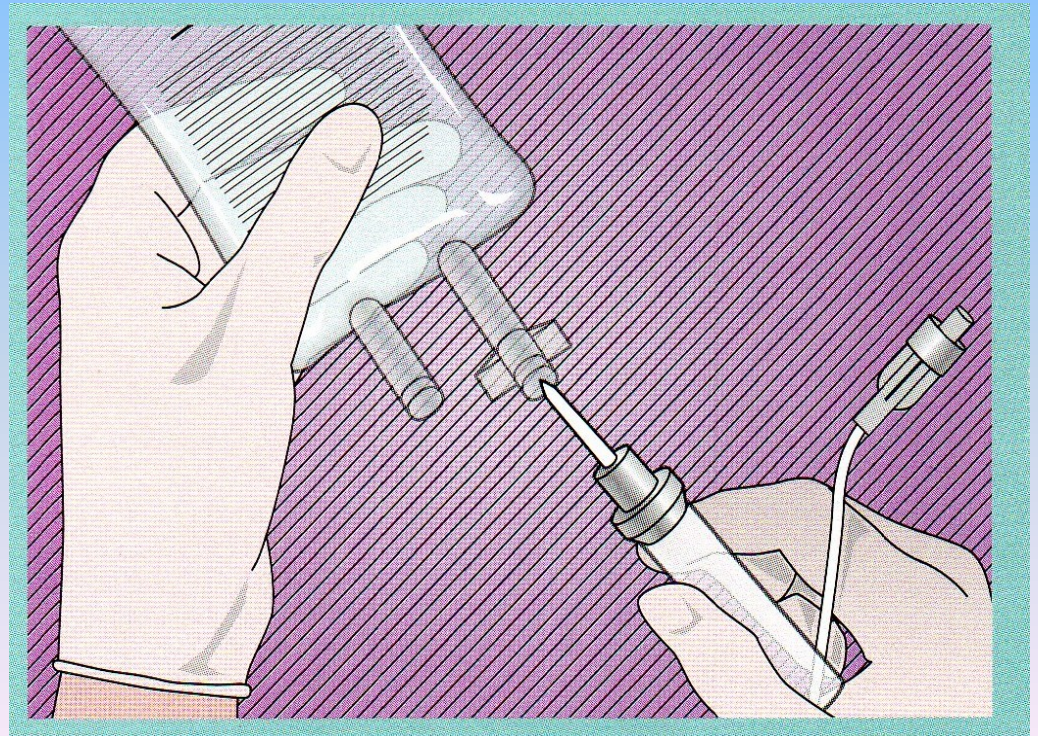
The procedure....I

- The correct patient should be identified , consent obtained and information and reassurance given
- The fluid to be infused should be checked against the prescription by two practitioners – check date of prescription, expiry date of fluid and directions
- Check infusion set contents for signs of contamination
- Wash hands, don clean gloves and apron



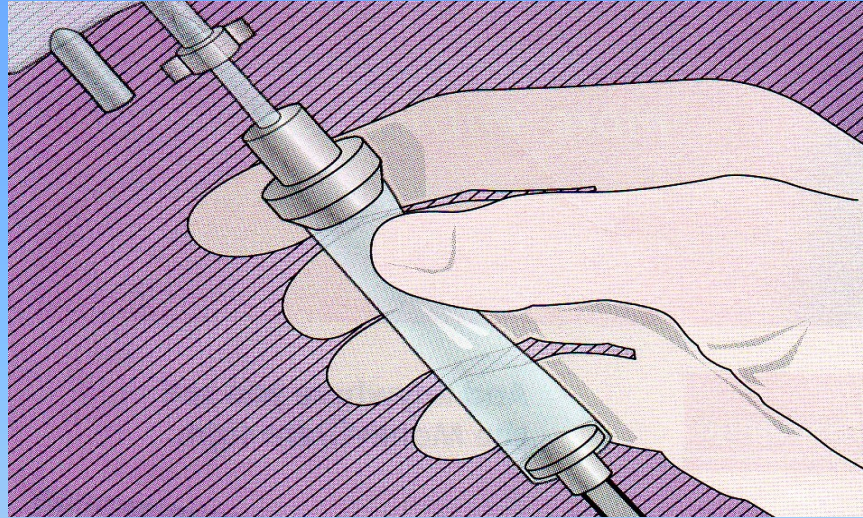
The procedure...II

- Remove any packaging. Maintaining asepsis, snap the seal where the administration set trocar is to enter the bag (invert the bag). If possible, hang fluid on a drip stand
- Close any flow controllers on the administration set. Expose the trocar without touching and advance into the appropriate port

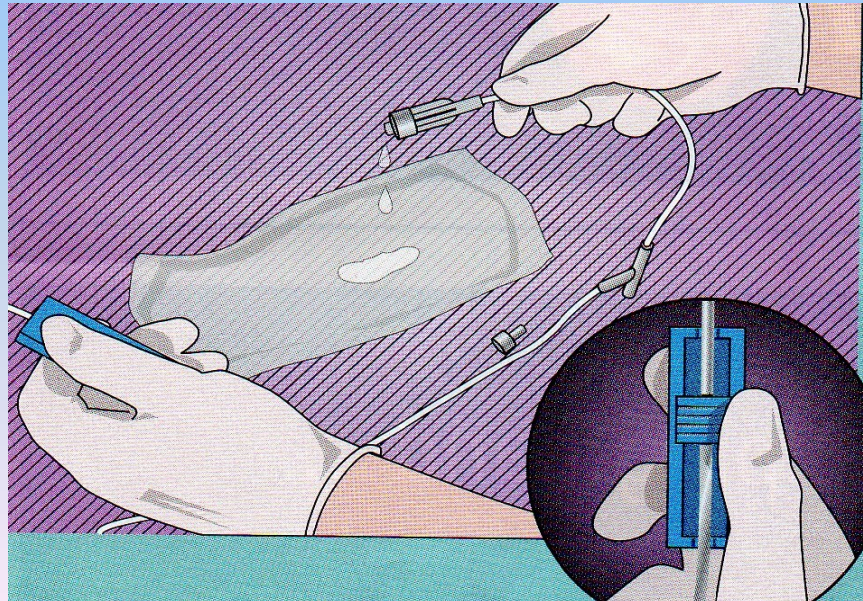


The procedure...III

- Gently squeeze the drip chamber, allowing it to partly fill with fluid

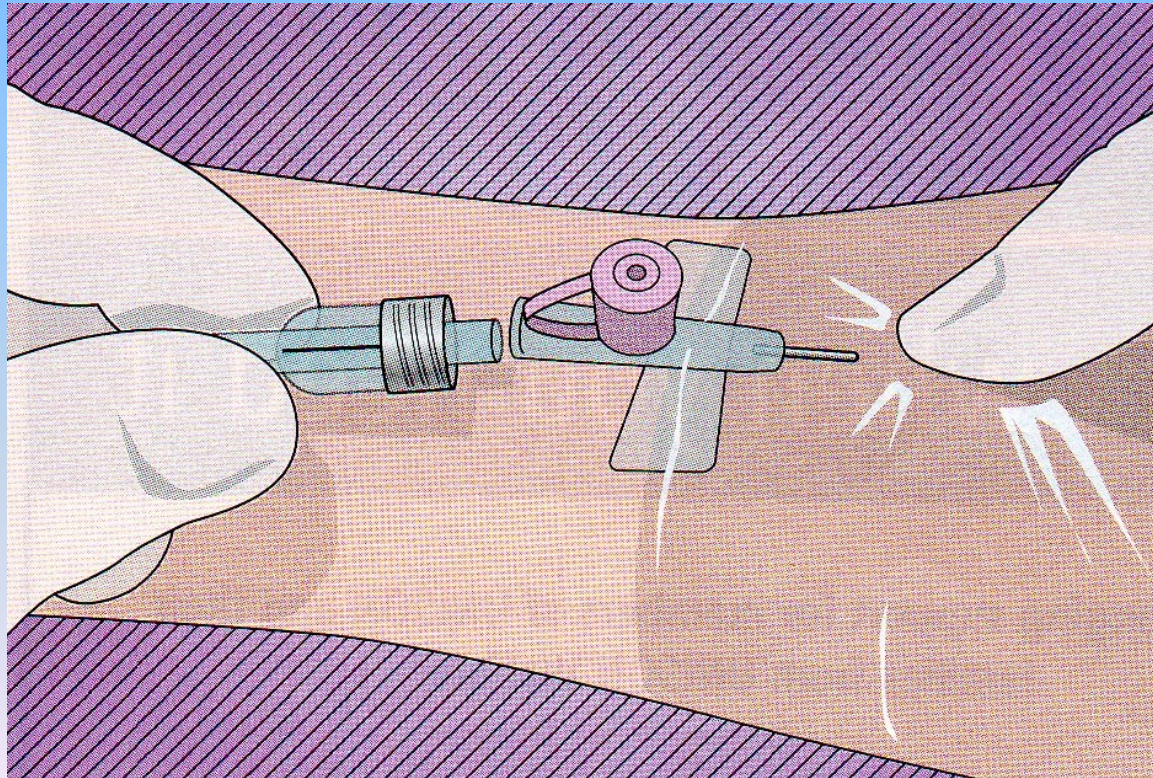


- Partially release the flow controller to allow fluid to fill and move through the tubing. This may require removing the protective cap at the luer lock connector to allow air to be expelled



The procedure...IV

- Expel any air by allowing the fluid to run through the set into a receptacle
- Connect to patient's intravascular device according to local policy and DOCUMENT the procedure



References

<http://www.cwladis.com/math104/lecture6.php> (Last accessed on March 7th 2010)

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