

## Routes of parenteral administration

As noted above medicines are injected by many different routes and the choice of route is governed by the purpose of the treatment and the volume of medicine to be administered.

### Intravenous injections and infusions

Intravenous (IV or i.v.) injections and infusions are administered into an easily accessible prominent vein near the surface of the skin, typically on the back of the hand or in the internal flexure of the elbow. The volumes administered can range from 1 mL for an intravenous injection, up to several litres for an intravenous infusion. Medicines administered by intravenous injection (or intravenous bolus dose) will rapidly increase the concentration of the drug in the plasma and produce a rapid effect. If the medicine is first added into a large volume of fluid (500 mL to 1 L infusion bag) and then administered by intravenous infusion at a slow and controlled rate, often utilising a pump, the drug will enter the circulation at a much slower and controlled rate. By altering the infusion rate it is possible for the clinician to titrate the dose against the effect required, e.g. controlling blood pressure, by manipulating the infusion rate of, for example, an inotropic drug such as dobutamine.

Drug solutions at high or low pH or highly concentrated hypertonic solutions (see below) will damage the cells lining the vein and cause localized pain and inflammation (thrombophlebitis). In order to avoid this problem a *central line* may be inserted. This is a long, indwelling catheter inserted into a vein in the neck or forearm with the end of the catheter sited in the superior vena cava close to the right atrium of the heart (see Fig. 36.1). Medicines administered intravenously, via a central line, become rapidly diluted in a large volume of blood and do not cause local irritation to the blood vessel. It is worth noting that injections which are formulated either as water in oil emulsions or suspensions must not be administered by the intravenous route. This is because the suspended drug particles can physically block blood capillaries and the oil phase of a water-in-oil injection could cause a fat embolism, again blocking blood vessels.

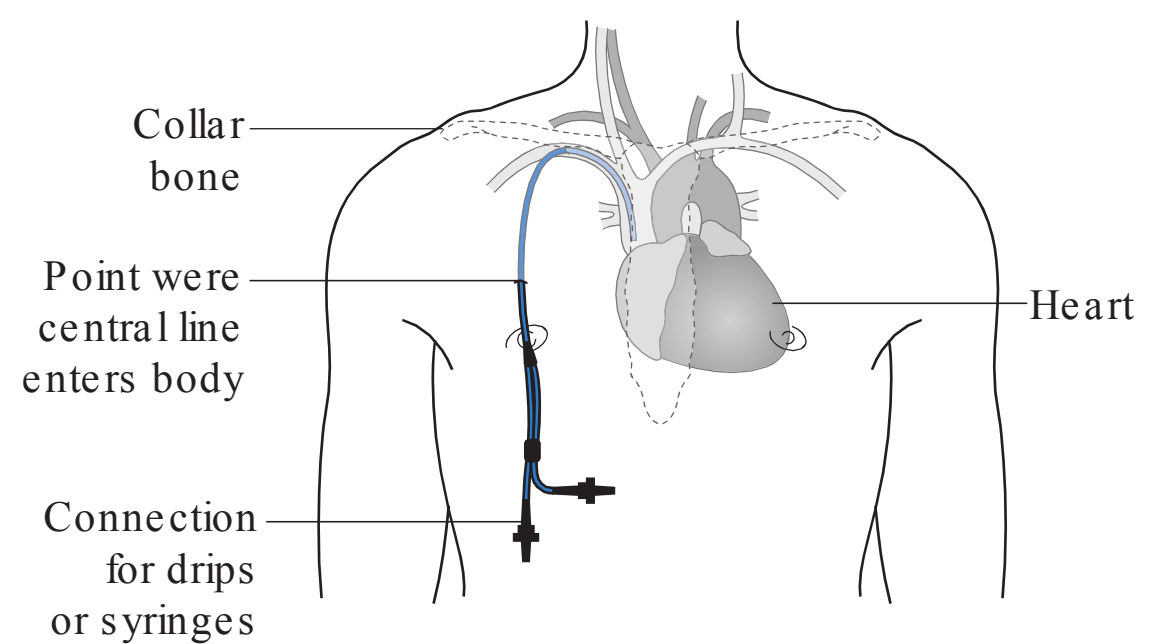


Fig. 36.1 • Central-line placement.

### Intra-arterial and intracardiac injections

The large majority of drugs that are administered parenterally are given intravenously. As noted above, this delivers the drug directly into the blood stream to provide a rapid and predictable clinical effect. However, it is not the only way that medicines can be administered into the vascular system.

Intra-arterial administration is essentially the same as intravenous administration except that the drug is administered into an artery rather than a vein. Arteries are not as readily accessible as veins and this technique is much more invasive, and carries a greater risk than simple intravenous administration. For this reason it is seldom used. Intra-arterial administration is sometimes used when intravenous access cannot easily be established, such as in very premature infants, due to the very small size of their veins in relation to the catheter tubes used to maintain vascular access. Intra-arterial administration has also been used in the treatment of some cancers (such as liver cancer) where the anti-cancer medicines are injected into an artery upstream of the tumour site to ensure the maximum amount of drug reaches the tumour before distribution elsewhere around the body. However, the benefits of this method of administration do not appear to outweigh the risks to any significant degree.

Intracardiac injections are used to administer a drug (a common example being an aqueous solution of adrenaline) directly into either cardiac muscle or into a ventricle of the heart. This is undertaken only in life threatening emergencies to produce a rapid, local effect in the heart during a heart attack or in circulatory collapse.