University College London Hospitals NHS
NHS Foundation Trust

Injectable Medicines Administration Guide

Pharmacy Department



Third Edition

WILEY-BLACKWELL

Also available online at www.uclhguide.com

UCL Hospitals Injectable Medicines Administration Guide

Quick User Guide

Users of the UCL Hospitals Injectable Medicines Administration Guide should be familiar with the terminology used in the monographs. A full explanation of the terms is found in the User Guide and Tutorial in Section B. For quick reference, the key abbreviations are listed here.

Method of administration	Description
IV bolus	Intravenous bolus
(I) IV infusion	Intermittent intravenous infusion
(C) IV infusion	Continuous intravenous infusion
SC bolus	Subcutaneous bolus
(C) SC infusion	Continuous subcutaneous infusion
IM	Intramuscular injection

Diluent	Definition
NS	Sodium chloride 0.9%
W	Water for injections
G	Glucose 5% (dextrose monohydrate)
G10	Glucose 10%
G20	Glucose 20%
H	Compound sodium lactate (Hartmann's or lactated Ringer's)
GS	Glucose 4% and sodium chloride 0.18%

Infusion device	Description
Volumetric pump	A device which pumps fluid from a reservoir, such as an infusion bag or bottle, through an administration set at a preset rate
Syringe pump	A device which delivers fluid from a syringe into an administration set at a preset rate
Syringe driver	A portable device which delivers fluid from a syringe into an administration set at a preset rate

Term	Definition/Explanation
Reconstitute	Add fluid to a dry powder to produce a solution or suspension
Dissolve	Add fluid to a dry powder to give a solution
Diluent	The fluid used to either reconstitute a powder, or to further dilute a drug solution or suspension
Dilute *to* XmL fluid	Add fluid to the container so the final volume is X. For example, if the instruction says "dilute dopamine 200 mg/5 mL to 20 mL water", the user should take the dopamine and mix it with water so that the final volume is 20 mL. The final concentration is dopamine 200 mg/20 mL, or 10 mg/mL.
Dilute *with* XmL fluid	Add XmL to the container. For example, if the instruction says "dilute dopamine 200 mg/5 mL with 20 mL water" the user should take the dopamine and add 20 mL water, so that the final volume is 25 mL (20 mL from the water, 5 mL from the drug). The final concentration is dopamine 200 mg/25 mL, or 8 mg/mL

Understanding the NPSA risk rating: a full explanation of the risk rating scale is provided in the User Guide. The number bar indicates the complexity of the adjacent preparation and administration method. It is colour coded to give a visual indication of the risk: low risk tasks are green, moderate risk tasks are amber, and high risk tasks are red. The user should take additional time to plan and prepare medicines with a high risk rating, ensuring local protocols are adhered to, and appropriate safety measures and patient monitoring are in place.

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UCL HOSPITALS

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Preface

The *UCL Hospitals Injectable Medicines Administration Guide*, Third Edition, is a fully revised and updated version of the previous editions published in 1997 and 2007. The general structure and format remain unchanged. The positive feedback we have received from nurses, pharmacists and doctors across the globe demonstrates that the *Guide* is a winning format. As computer-based systems are being introduced to manage all aspects of patient care, including patients' medicines, an internet version of the *Guide* has been launched. In 2009 the *UCLH Guide* online went live (www.uclhguide.com) to meet the demand for up-to-date information in the digital age.

Healthcare is a rapidly evolving field, and in recent years patient safety has become an NHS priority. There is great interest in reducing the risk associated with injectable medicines, particularly since the publication of the National Patient Safety Agency alert *Promoting Safer Use of Injectable Medicines*. The injectable practices within the UCLH have been thoroughly scrutinised; every identifiable practice has been risk assessed and risk reduction strategies introduced. At UCLH we believe we are now working in a safer environment: we have rationalised the injectable products we use, expanded the range of ready-to-use injectables on our formulary, introduced guidelines to support those who prescribe, dispense and administer high-risk injectables and improved the training package for new staff who give injectables. Many of the risk reduction strategies have resulted in amendments to the monographs that form the core of this publication. Staff in the pharmacy department of UCLH are proud in the knowledge that their hard work is protecting patients through the safer use of injectable medicines, and we are happy to share the progress we have made through the *Guide*.

The opening chapters of the *Guide* have been revised to reflect recent changes in the use of injectables. Many concepts in the introductory chapters have been expanded to give the reader a more comprehensive overview of injectable therapy. Examples from current practice have been given so that readers can relate their own experiences to the text. A tutorial and example monograph has been added to make it easier for new users to get to grips with the *Guide*. This edition features over

40 new monographs, ranging from abatacept to zoledronic acid. A large number of unlicensed medicines have been added to support those administering medicines for which there is a paucity of information. The existing monographs have been overhauled to ensure they include all methods of administration, whether licensed or unlicensed, widespread or specialist. In many cases bold decisions have been made in order to give the user the best possible advice, which may differ from the drug manufacturer's recommendations. The compatibility section now includes much more detailed information about possible compatibilities. This means that those caring for critically ill patients, who often require multiple concurrent infusions, now have a greater range of options when medicines need to be co-infused.

Finally information to support the use of injectable medicines in paediatric and neonatal patients has been included wherever possible. When these patients require special dilutions or infusion rates, this is highlighted. Advice about the preparation of low volume medicines for administration to neonates, and the use of displacement values to ensure accurate dosing in children, is embedded in the monographs.

In short, this is the safest and most comprehensive *UCLH Injectable Medicines Administration Guide* to date.

We trust that you will be satisfied with the *Guide*; however, we continuously strive to improve. Your comments, criticism and suggestions for change are gratefully received. This feedback is essential to ensure that the *Guide* continues to lead in the field of injectable medicines.

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Please send your comments to: injectable.guide@uclh.nhs.uk

Section A

1 Introduction

The use of injectable products is fundamental to modern healthcare. Almost every patient admitted to hospital will be prescribed intravenous fluids, or an intravenous medicine. It is essential that healthcare workers who prepare and administer injectables have access to concise information to ensure they use the products appropriately. This need has prompted the publication of the *UCL Hospitals Injectable Medicines Administration Guide*.

The *Guide* includes information to support the prescribing, dispensing and administration of medicines given via the intravenous, subcutaneous and intramuscular routes. It includes a wealth of background information, including descriptions of the various methods of administration, the relative merits of each method, the devices used to give injectables, and pharmaceutical issues that may influence therapy. The *Guide* incorporates both local practice advice and some nationally accepted best practice guidance, including a summary of aseptic non-touch technique.

2 Overview

2.1 Organisation of information in the *Guide*

The *Guide* comprises two sections:

Section A outlines the responsibilities of the various professionals involved in the prescribing, dispensing and administering of injectables. Full descriptions of the methods of intravenous administration are given, while the infusion devices used to deliver medicines and fluids are discussed. Practical guidance on flushing lines and cannulae, management of extravasation, and drug compatibility is provided. The use of drugs in a syringe for subcutaneous infusion and pharmaceutical aspects of intravenous therapy are also detailed.

Section B starts with a user guide which fully explains the information in the drug monographs. New users can work their way through a tutorial to aid interpretation of the monograph content. The remainder of section B contains the individual medicine monographs in tabular form. Medicines are arranged in alphabetical order and include the following information:

- Formulation.
- Injectable method of administration and recommended infusion device.
- National Patient Safety Agency (NPSA) risk rating.
- Preparatory instructions for the medicine.
- Administration details.
- Recommended flush fluid.
- A list of adverse effects that may result from administration.
- Pragmatic 'in use' advice from clinicians at UCL Hospitals.
- Compatibility data for the medicine with fluids and other drugs for both intravenous and subcutaneous use.
- Pharmaceutical particulars, including pH, tonicity, sodium content and displacement value.

Cytotoxic medicines are beyond the scope of the *Guide.*

2.2 Sources of information and disclaimer

The majority of information in the *Guide* is based on the best available published data at the time of writing. However, some of the advice given is representative of practice at UCL Hospitals and may not be consistent with licensed information found on the manufacturers' summary of product characteristics (SPC). Each monograph has been carefully constructed to give pragmatic preparatory instructions to support those administering the drug. For example, the preparatory instructions from the manufacturers of some medicines, such as abatacept, phytomenadione and ertapenem, have been simplified to reduce the number of steps required to get the medicine ready to administer to the patient. At UCL Hospitals we believe that the simplest methods are the safest. All deviations from manufacturer's advice are supported by literature.

Administration advice for certain patient groups, including children, neonates and the critically ill, has been verified by specialist pharmacists and nurses with first-hand experience of using the medicine. All the advice is given with patient safety at the fore.

Published compatibility data are ***not*** available for all the combinations and situations covered in this *Guide*. Some of the advice and information therefore reflects local practice and experience only. Readers are reminded that slight variation in the exact combination and concentrations of medicines can adversely affect compatibility. Readers are referred to their local hospital pharmacy department for more specific information and advice.

Neither the authors nor the publisher can accept any legal responsibility or liability for any errors or omissions that may be made within the *Guide*. Readers should take their own precautions to ensure that new information published after the *Guide* was written is followed wherever possible. Readers are referred to the SPCs produced by the pharmaceutical companies for further or more up-to-date information. SPCs are periodically updated and thus the recommendation(s) for administering the medicines included in this *Guide* may alter from time to time.

3 UCLH policies

3.1 Responsibilities of professional staff at UCLH

3.1.1 Nurses' and midwives' responsibilities for injectable medicines (including blood products, IV fluids and IV medicines)

Nurses are referred to the *Standards for Medicines Management* of the Nursing and Midwifery Council and the *Standards for Infusion Therapy* published by the Royal College of Nursing. These provide a comprehensive description of the responsibilities of a practitioner when administering a medicine. Other healthcare professionals will find these documents useful as these standards are universally applicable.

At UCL Hospitals, injectable medicines may be prepared and administered by a registered nurse/midwife as described in UCL Hospitals *Administration of Medicines by Nurses/Midwives Policy and Procedure* document. This document is available from UCL Hospitals.

3.1.2 Pharmacists' responsibilities for injectable medicines

- Pharmacists should provide appropriate information and advice to medical, nursing and other health professionals on pharmaceutical aspects of parenteral medicines, e.g. choice of medical therapy, compatibility, stability, dosage and administration details.
- Pharmacists should monitor prescriptions for parenteral medicines and alert medical and/or nursing staff to any potential problems. Pharmacists should annotate prescriptions for parenteral medicines where appropriate.
- Pharmacists should ensure patients are switched at the earliest opportunity to oral therapy, to minimise risk from IV therapy.
- Pharmacists should provide education and training to healthcare professionals involved in the administration of parenteral medicines.
- Pharmacists will monitor medication errors in local clinical areas, provide targeted training to those involved in the incident and formally report the error. Lessons learned from the incident should be disseminated to colleagues to ensure best practice in all areas.
- Pharmacy will prepare some medicines to be administered by the parenteral route as locally agreed. This centralised intravenous additive service (CIVAS) prepares cytotoxic medicines, intravenous nutrition, monoclonal antibody infusions and a selected group of high-risk medicines such as foscarnet and ganciclovir.

3.2 Preparation of injectable medicines on wards, clinics and departments at UCLH

Injectable medicines:

- **Must not** be prepared in advance of their immediate use
- **Must not** be prepared by anyone other than the registered nurse/midwife or doctor who is going to administer them, unless they are prepared in his or her presence.

All medicines prepared must be appropriately labelled. Additive labels should be completed and attached to the infusion container.

Exceptions:
Injectable medicines may be prepared in advance if covered by a specific protocol agreed by relevant pharmacy and nursing staff. In emergencies practitioners are not required to label medicines, but if several medicines are prepared at the same time, individuals should ensure they are able to identify each separate medicine, and any pre-prepared flushes.

4 An overview of intravenous therapy

There are multiple routes of drug administration including oral, topical, rectal, inhalation, intravenous, intramuscular, subcutaneous and intrathecal injection. A prescriber must decide which is the most appropriate route of administration for a medicine according to the clinical condition of the patient. Intravenous injection is defined as the introduction of medicine or infusion fluid into a vein.

4.1 When is intravenous therapy appropriate?

Intravenous therapy may be the most appropriate option when:

- High plasma levels of a drug are required rapidly. Unlike other routes, the drug is introduced directly into the bloodstream and is available to exert its pharmacological effect as soon as it enters the body. Medicines given by other routes need to be absorbed into the bloodstream first, which can take considerable time. Oral medicines are usually absorbed from the small intestine, while medicines administered intramuscularly must be absorbed from muscle fibres into the bloodstream. The intravenous route is usually the route of choice in emergencies because it is usually the fastest way to achieve a therapeutic effect.
- Tight control of drug levels is required, with the need for small adjustments to the rate of administration, according to the patient's response. This can be achieved by giving the drug as a continuous infusion. Examples of such infusions include insulin for blood glucose control and the infusion of anaesthetic agents during surgery to maintain unconsciousness.
- Patients are unable to take oral medication. This may be because they are vomiting or unconscious, or because they have had recent gastrointestinal surgery.
- Patients are unable to absorb medicine orally, for example those who have severe diarrhoea, active Crohn's or coeliac disease.
- Rapid correction of fluid or electrolytes is required, for example after haemorrhage.
- Other routes are not available. For example, the intramuscular route may not be appropriate in the very young or the very old as they tend to have a reduced muscle mass, which is not ideal for the administration of medicines. Those receiving anticoagulant medicines or patients with clotting diseases such as haemophilia may bleed from the IM injection site.
- Other routes are not acceptable to the patient. IM injections can be painful, and may be refused, even by healthy individuals. Many UK patients refuse suppositories.

4.2 Drug factors that influence the choice of route

Some medicines must be given by the intravenous route because of their chemical or pharmacological properties.

4.2.1 Absorption

Some drugs are broken down by gastric secretions, which prevents them from being given orally. Proteins such as insulin and infliximab are inactivated in the gut so must be injected. Other drugs do not possess the chemical properties to cross the gut wall so cannot be given orally to cause a systemic effect. However, these drugs may still be useful for treating diseases of the gastrointestinal tract, e.g. vancomycin cannot be given orally to treat a systemic infection as it is not absorbed, but can be used to treat *Clostridium difficile* infection of the intestine.

Some drugs may be given by subcutaneous, intramuscular or rectal routes, but the absorption from these sites may be erratic and unreliable. Gentamicin may be given by IM injection, but to treat serious infection the intravenous route is used in preference as therapeutic levels are more likely to be achieved.

4.2.2 The first-pass effect

Medicines given orally are usually absorbed in the small intestine. They are then transported in the blood, via the portal system, to the liver where they may be metabolised. For some medicines, metabolism in the liver occurs to such a great extent that little medicine reaches the target organ – this is called the first-pass effect (or first-pass metabolism). The intravenous route avoids the first-pass effect as the drug is introduced directly into the systemic circulation. It is precisely for this reason that some drugs, e.g. verapamil and propranolol, need to be given at much higher doses orally, than by intravenous injection, to produce a similar therapeutic effect. For some medicines, such as lidocaine, it is not possible to make an oral formulation because the metabolism is so great.

4.2.3 Impact of half-life

The elimination half-life ($t_{1/2}$) is the time taken for the concentration of medicine in the blood to fall to half its original value, e.g. if a medicine has a half-life of 4 hours, this means that it will take 4 hours for the concentration of the medicine in the blood to fall from 10 mg/L to 5 mg/L. Medicines can have half-lives that are measured in seconds, minutes, hours or days.

Medicines with very short half-lives disappear from the bloodstream very quickly and may need to be administered by a continuous infusion to maintain a

clinical effect on tissues, e.g. dopamine has a half-life of 1–2 minutes and so has to be given as a continuous infusion. When the infusion is stopped its effects will be lost within minutes.

If a medicine has a longer half-life, it means that it may be given as a bolus injection or intermittent infusion instead of a continuous infusion, and its effects on the body tissues will last for several hours before another dose is needed. Knowledge of half-life alone is not, however, sufficient in determining the method of administration because many other factors need to be taken into consideration, e.g. drug distribution into tissues.

4.3 Disadvantages of intravenous administration

- A vascular access device (VAD) such as a cannula or catheter must be placed before any intravenous medicine can be given. This requires specially trained personnel and specific equipment.
- Obtaining vascular access can be difficult. Patients who have been regularly cannulated in the past, are in shock, are dehydrated or have fragile veins may be difficult to cannulate. Insertion of a central venous catheter requires specialist training and is an invasive procedure.
- When medicines are given by the intravenous route there is an increased risk of toxicity. Side effects may occur immediately and can be severe.
- Preparation of some intravenous medicines is complicated and can be time consuming. It may require complex calculations, multiple steps in reconstitution and dilution, competence in the aseptic non-touch technique and the use of infusion devices.
- Contamination of medicines and infusion fluids during preparation, or contamination of the VAD during administration, may result in infection as microbes are introduced directly into the bloodstream.
- There is a risk of embolism each time an intravenous medicine is given, from blood clots from the VAD or from inadvertent injection of air or particulate matter.
- There is a risk of fluid overload from the administration of multiple medicines diluted in large volume infusion bags, or through the overzealous use of intravenous infusion fluids.
- There is a risk of pain, irritation and extravasation at the injection site.
- Some patients are afraid of needles and injections and will object to their use.

4.4 Routes of intravenous administration

Intravenous administration can be divided into peripheral and central administration. Catheters and cannulae are described as 'vasular access devices' or 'venous access devices' (VADs), although in everyday language they are called 'lines'.

4.4.1 Peripheral administration

Peripheral administration is introduction of fluid into a peripheral vein. Veins are accessed via a cannula, which is most often placed in the veins of the lower portion of the arm because they are located just below the skin. Veins used for cannulation include the cephalic, basilic and metacarpal veins. Antecubital and dorsal veins may also be used. Each site has its advantages and disadvantages, which are beyond the scope of the *Guide*.

4.4.2 Central administration

Central administration is introduction of fluid into a large central vein, through a central venous catheter (CVC). The tip of a CVC terminates in the superior vena cava, right atrium or inferior vena cava. Infused fluids are rapidly diluted in the fast flow of blood in the vessel. There are a variety of CVCs – the choice of device will depend on the intended use and multiple patient factors. Refer to local CVC guidelines for a description of the devices available and their relative merits. UCLH has a central venous catheter care guideline which may be accessed via the hospital intranet.

4.4.3 Peripheral versus central vein administration

Peripheral vein administration

Advantages

- Simple to insert a cannula.
- Less traumatic compared with central line.
- Cheap.
- Cannula easy to manage for clinical staff.

Disadvantages

- Limited time period of use.
- Blocks more easily.
- Risk of infection.

- Greater risk of extravasation/phlebitis compared to a central line.
- Single lumen.
- Not suitable for certain medicines.

Central vein administration

Advantages

- Allows the administration of irritant solutions, e.g. concentrated potassium solutions or vasoactive medicines.
- Allows rapid administration of large volumes of fluid, e.g. in shock.
- Provides long-term venous access, which is useful for patients requiring intravenous therapy over extended periods, such as those having chemotherapy in cycles or intravenous nutrition (TPN) at home.
- To enable administration of concentrated solutions of medicines, which would normally need further dilution as a result of their irritancy. This is particularly useful in fluid-/sodium-restricted patients.
- Allows the co-administration of multiple medicines without the risk of incompatibility. Most CVCs have more than one lumen, which terminate at slightly different points so that medicines do not mix on infusion.

Disadvantages

- Catheters require a short procedure to be inserted, which takes more skill and time than inserting a cannula.
- Healthcare staff must be specially trained to care for the catheter.
- Insertion can be painful/traumatic.
- There is a risk of serious infection. The exit site (where the catheter comes out of the skin), the outer surface of the catheter and the inside lumen may all be colonised by microbes. This can lead to septicaemia and removal of the catheter.
- Overall more expensive to insert and manage than a cannula.

Section B of the *Guide* advises which medicines should be administered by a central line.

5 Factors affecting patency of intravenous sites

Peripheral cannulae are generally used for around 72 hours before they need to be removed and resited. The vein can become irritated and flow through the cannulae is reduced or stops. CVCs may be used for days, weeks or months depending on the type of catheter inserted. Some factors that influence how long a VAD will remain patent are common to both types of device and are described below.

5.1 Factors increasing failure of intravenous sites

- Infection.
- Irritation:
  - Movement, particularly of cannulae in areas of flexion.
  - Cannula material (steel is more irritant than Teflon).
  - Infusion of particulate matter, which physically blocks cannulae.
  - Infusion of irritant medicines.

5.2 Factors decreasing failure of intravenous sites

- In-line filters help reduce the number of particles infused. Administration sets with 15 micron filters are standard at UCLH. Smaller pore filters may be provided with some medicines that have a tendency to precipitate.
- Good practice/aseptic technique when the VAD is first inserted and each time it is accessed.
- Infusion of dilute solutions of medicines or electrolytes, which tend to be less irritant.

5.3 Occlusion of central venous catheters

Central venous catheters may be occluded by clotted blood, a fibrin sheath, precipitated medicines or the components of intravenous nutrition. Local catheter care guidelines should give advice on how to manage such events. Catheters occluded with a fibrin sheath may be unblocked using urokinase 5000 unit/mL instilled into the catheter lumen using a ‘rocking technique’ between two syringes attached to the lumen with a three-way tap.

6 Methods of intravenous administration

Medicines are given using a variety of methods which are outlined below. The choice of method may depend on the pharmaceutical properties of the drug, the clinical condition of the patient, the desired therapeutic outcome, and the type of venous access the patient has. It should be noted that there is no consensus regarding the definitions of bolus injection and intermittent and continuous infusion. Definitions in the literature and manufacturers' SPCs may differ slightly from those given here. However, the descriptions below are consistent with the administration methods given in Section B of the *Guide*.

6.1 Intravenous bolus

Introduction of a small volume of medicine solution into a vascular access device is referred to as a bolus injection. A bolus injection is usually administered over 3–5 minutes to minimise vein irritation and the risk of extravasation. Drugs typically given by bolus injection include penicillin antibiotics, such as amoxicillin, and antiemetics, such as cyclizine.

During cardiac resuscitation and other emergencies a bolus may be given over a few seconds as the risk of rapid administration is outweighed by the clinical need for immediate therapeutic effect. Adenosine, used for cardiac arrhythmias, is administered as quickly as possible as it is rapidly inactivated in the blood and would not reach the heart otherwise.

At UCLH a bolus is defined as any injection given in 5 minutes or less, and is less than 50 mL in volume. It is considered impractical to administer a bolus over longer than 5 minutes. The *Guide* recommends that medicines that need to be given over a time period of greater than 5 minutes or that are greater than 50 mL are prepared as an intermittent infusion.

Advantages

- Achieves immediate and high medicine levels.
- Easy and more convenient for the practitioner. There are much fewer steps required to prepare and give a bolus compared to an infusion. Bolus injections do not require dilution to large volumes of infusion fluid, priming of an administration set or programming of an infusion device.
- After giving the dose the practitioner can be sure the patient has received the dose and does not need to monitor an infusion bag/device (c.f. intermittent and continuous infusions).

Disadvantages

- Increased potential for adverse effects, particularly if the dose is given too rapidly, e.g. cyclizine.
- Damage to the veins, e.g. phlebitis or extravasation, especially with potentially irritant medicines.

6.2 Intermittent intravenous infusion

Administration of an infusion over a set time period, either as a one-off dose or repeated at specific time intervals, is referred to as an intermittent infusion. An intermittent infusion of medicine is often a compromise between a bolus injection and continuous infusion. It achieves high plasma concentrations rapidly to ensure clinical efficacy yet reduces the risks of adverse reactions associated with rapid administration.

Many medicines are given as intermittent infusions, including gentamicin, metronidazole and Pabrinex.

At UCLH intermittent infusions are defined as any infusion given over longer than 5 minutes but less than 24 hours. Most infusions are given over an hour, although large-volume fluids, e.g. 1 L compound sodium lactate, are usually given over 8 hours.

6.3 Continuous intravenous infusion

Intravenous administration of a fluid or medicines over 24 hours is referred to as a continuous infusion. The infusion may be repeated over a period of days. Large volumes (i.e. 250–1000 mL) or small-volume infusions (e.g. 50 mL) may be delivered continuously.

Advantages

- May be used to maintain a constant therapeutic concentration of a medicine. For example, some centres may use constant infusions of antibiotics to maintain high blood levels.
- Allows the infusion rate of a medicine to be accurately titrated according to patient response. Morphine infusions for pain control may be adjusted according to the patient's pain and also their level of sedation and respiratory rate. Insulin infusions are titrated according to blood glucose.
- Allows administration of medicines with a short elimination half-life to be given, e.g. adrenaline infusions are used to improve the strength of cardiac contraction in critical care.
- If the solutions are dilute they may be less irritating than bolus administration.

Disadvantages

- May be complicated to prepare. May require complex calculations and multiple transfers of medicine/fluids to produce a solution with the correct concentration.
- Requires the practitioner to be competent in the use of infusion equipment including syringe and volumetric pumps and administration sets.
- During administration the practitioner will need to monitor the infusion to ensure it is running into the patient. This can be very time consuming if an infusion regularly stops.
- Greater risk of microbial and particulate contamination (compared to bolus administration) because of the complexity of preparation.
- Greater risk of infection (compared to bolus administration) as the solutions are used for up to 24 hours, in which time microbes may grow in infusion fluids (particularly those containing glucose or fats, e.g. intravenous nutrition).
- The infusion occupies the VAD continuously. If the patient requires multiple medicines or fluids, more than one infusion may need to be given down the same lumen of a VAD leading to compatibility issues: before two infusions are given via the same lumen it must be confirmed they are compatible.
- Large volumes of fluid may cause fluid overload in some patients.
- Greater risk of pharmaceutical problems, such as drug degradation in solution and drug interaction with the infusion equipment.

6.4 Preparation and administration of intravenous medicines

The following checklist describes the process for preparation and administration of an intravenous medicine. The National Patient Safety Agency (www.npsa.nhs.uk) has produced an excellent and comprehensive standard operating procedure for the prescribing, preparing and administering of injectable medicines. Each item in the checklist below may be comprised of multiple processes itself. Practitioners should refer to the NPSA's document for a breakdown of the full process. Note the Nursing and Midwifery Council now advises that the preparation and administration of all injectable medicines should be second checked by another practitioner in order to minimise error.

- Check the prescription – check that the dose, time and route are correct.
- Understand what the medicine is for and how it works.

- Be aware of any local protocols for preparing and administering the medicine.
- Plan drawing up doses.
- Know how to administer each medicine, including:
  - Calculation of concentration and rate.
  - Reconstitution.
  - Addition of medicines to recommended diluents.
- Use aseptic non-touch technique to prepare the medicine.
- Thoroughly mix any additions, checking for precipitation or particles.
- Complete yellow infusion additive label and attach to infusion.
- Go to patient and check patient identification.
- Explain what you are doing to the patient, when appropriate.
- Check vascular access device.
- Check that any equipment required is working.
- Administer.
- Monitor patient for response and adverse effects.
- Monitor any infusion equipment to ensure it is functional throughout the administration. Monitor the drug solution for signs of precipitation.

6.5 Aseptic non-touch technique (ANTT)

ANTT is fundamental to the safe administration of injectables. Infection, as a result of poor aseptic technique when preparing injectables, or when handling a vascular access device, places a huge burden on healthcare systems. Infection from this route can be severe as microbes are introduced directly into the patient's bloodstream, quickly leading to systemic infection, significant morbidity and high rates of mortality. All practitioners must use ANTT every time an injectable is administered to a patient.

ANTT is an evidence-based method for standardising the aseptic technique of healthcare workers. It is a simple, efficient and logical approach which is the same for peripheral and central line access and for all patients. In IV therapy the focus is on avoiding microbial contamination of the 'key parts' at all the preparation and administration stages.

Key parts are those parts of the equipment that come into direct or indirect contact with the liquid infusion.

Healthcare workers should identify all key parts and then protect them at all times using a non-touch technique. On top of this fundamental principle, the ANTT guideline, importantly, standardises all the equipment to be used and the order in which the procedure is performed. Standardisation is paramount.

ANTT guidelines and resources can be found at www.antt.co.uk.

Here is a simple written overview of the ANTT guideline for IV therapy:

1. Clean hands with soap and water or alcohol gel.
2. Clean a plastic tray with an alcohol-based surface cleaner. Whilst drying …
3. Gather equipment, including medication, diluents, syringes, needles, etc.
4. Clean hands with alcohol gel or soap and water.
5. Put on non-sterile gloves (sterile gloves should be used if key parts must be touched).
6. Assemble equipment and prepare medicines, protecting key parts at all times by a non-touch technique. Prime the pump and expose the patient's IV port. If this is already done move on to step 7. Otherwise:
   - **6.1** Prime the pump
   - **6.2** Expose the IV port
   - **6.3** Dispose of gloves
   - **6.4** Clean hands with alcohol gel or soap and water
   - **6.5** Put on new non-sterile gloves.
7. Clean the key parts with a chlorhexidine gluconate 2% and alcohol 70% wipe. Scrub the port tip with different parts of the wipe, then allow to dry for 30 seconds.
8. Administer drugs using a non-touch technique.
9. Dispose of sharps and equipment, then dispose of gloves.
10. Clean tray with alcoholic wipes.
11. Clean hands with alcohol gel or soap and water.

For a pictoral flow chart of the above steps refer to the ANTT website.