

The Newcastle upon Tyne Hospitals NHS Foundation Trust

Injectable Medicines Policy – Supporting Information

Effective From: July 2010

Review Date: July 2012

This document has been written to provide further information and procedural guidance, where required on the prescribing, preparation, administration and monitoring of injectable medicines for use within the Newcastle Upon Tyne Hospitals NHS Foundation Trust. It should be read in conjunction with the Injectable Medicines Policy.

1. Professional Responsibilities for Registered Practitioners associated with Injectable Medicines.

The Policy states that all staff involved with the Prescribing, Preparation, Administration or Monitoring of an injectable medicine should be trained and competent. Further information on this is given below:

- Any practitioner who is involved in the processes leading to administration of an injectable medication to a patient is accountable for their actions and their omissions.
- Practitioners must exercise their professional judgement and apply their knowledge and skills every time they prescribe, prepare or administer a drug.
- Before administering any medicine, practitioners must know the therapeutic uses of the medicines to be administered, its normal dosage, side effects, precautions and contra-indications and any required management techniques for adverse drug interactions.
- Practitioners must always work within their own Codes of Professional Practice and the Newcastle Medicines Policy.
- Non Medical Practitioners must have either attended their designated clinical skills study day or have completed the Trust electronic training package (when available), and be signed off as competent by their line manager (see section 1.1)
- Intravenous Drug administration needs to be performed regularly in order to maintain competence in the procedure. If a training update is required then a subsequent assessment of competence needs to be undertaken.

Doctors

Any medical practitioner (including F1 doctors) is permitted to give drugs by the intravenous, intramuscular or subcutaneous routes (excluding cytotoxic medicines –see [cytotoxic policy](#)). In all cases they are expected to ensure they have the knowledge, skills, and understanding required before they give a drug by an injectable route.

Nurses and midwives including student midwives

Provided they are registered, nurses / midwives who have successfully completed the training pack and competency assessment for the preparation, administration and monitoring of peripheral intravenous drugs (including newly qualified), may prepare and administer intravenous medicines peripherally. Intramuscular and Subcutaneous injections may also be given following observation of satisfactory practise by a senior nurse.

Central line administration of injectable medicines is permissible only after completion of training and competency assessment as detailed in the Trust Central Venous Access and Midline Catheters Competency Assessment Document.

Operation Department Practitioners (ODP)

Operating Department Practitioners who have successfully completed the training pack and competency assessment for the preparation, administration and monitoring of peripheral intravenous drugs can administer intravenous medicines peripherally, or solutions containing intravenous additives.

Central line administration of injectable medicines is permissible only after completion of training and competency assessment as detailed in the Trust Central Venous Access and Midline Catheters Competency Assessment Document.

Nurses with community responsibilities

Nurses whose roles include both hospital and community practice are required to work within the directives of the [Injectable Medicine Policy](#). This relates to both preparation and administration of intravenous medications, as well as in training patients and carers. If it is unavoidable that practice varies for this speciality, then this variation should be covered by individual approved protocols.

Patients receiving intravenous treatment at home should continue to receive their first dose in the hospital setting except where specific approved protocols are in place.

Radiographers

Radiographers who have successfully completed the training pack and competency assessment for the preparation, administration and monitoring of peripheral intravenous drugs may administer intravenously as defined by departmental protocol, or otherwise prescribed by a radiologist, medicines required for contrast enhanced radiological procedures. They may also administer intravenously as defined by departmental protocol, or otherwise prescribed by a radiologist, pre-prepared radio labelled pharmaceuticals and any other medicines required for nuclear medical imaging or therapeutic procedures.

Cardiac Perfusionists

Cardiac perfusionists (including those in training) who have successfully completed the training pack and competency assessment for the preparation, administration and monitoring of peripheral intravenous drugs can administer intravenous

medicines to patients undergoing cardiac by-pass under the direct supervision of an anaesthetist or cardiac surgeon.

Pharmacists

Pharmacists may perform the calculation check required for preparation of injectable medicines. They may also perform the independent second check of the preparation process. These checks are detailed in section 7.1

Students: from any healthcare profession groups excluding midwives.

Newcastle Upon Tyne Hospitals NHS Foundation Trust, Northumbria University and Newcastle University consider intravenous administration to be an advanced competency that can only be achieved post qualification. Students, regardless of professional group, may therefore only observe the administration of intravenous drugs, and must only participate in any of the other processes involved under direct supervision as a third participant.

Agency, Bank, and Locum Staff

Agency, or locum staff, who have undergone prior intravenous therapy training within Newcastle Upon Tyne Hospitals NHS Foundation Trust, or elsewhere are required to provide evidence of this training and subsequent updates to the nurse in charge before they can administer intravenous medications in the clinical area.

1.1 Training

The administration of intravenous medicines, (including simple infusions which have had an injectable medicine added to them), requires specific training. Guidance on the training and accreditation process appropriate for individual professional groups should be obtained from their Clinical Management Team manager or professional lead.

Medical staff Injectable training is provided for junior doctors via the Foundation Programme.

Training available within the Trust is detailed below. Registered practitioners with an involvement in injectable medicines are recommended to either attend the clinical skills training or complete the electronic training package (see section 1.1.2)

1.1.1 Clinical Skills Training

This non medical training incorporating injectable medicines is available as part of the Clinical Skills Training Package. This training is coordinated by the Directorates. Advice on how to participate in this training can be obtained by contacting the Directorate Clinical Educator. Where the Directorate does not have a designated Clinical Educator, advice should be sought from Directorate Managers. Training and assessment is open to and recommended for all members of staff whose duties include intravenous preparation, administration and monitoring of drugs.

1.1.2 Electronic Training

Currently, an online training package on injectable medicines is available via the learning zone. This is a [BMJ elearning module](#) which provides an “off the shelf” learning package commissioned by the NPSA in response to Patient Safety Alert 20 “Promoting the safety of injectable medicines”. Registration is required with BMJ elearning. This is a simple process completed by following the link above, and then clicking on the top right hand button “register here for free modules.”

The module describes general principles of risk in relation to injectable medicines, as well as giving teaching on the preparation of injectable medicines, including the requirement to complete basic calculations.

This module is suitable to be undertaken by any practitioner, involved in prescribing, preparing or administering injectable medicines. ***However, the following provisos should be read and understood and kept in mind whilst undertaking the module.*** These provisos are made in line with NuTH policies and procedures:

- **Photographs**

Some photographs show outdated practices, particularly with respect to Infection Prevention and Control (IPC):

Ported cannulae are shown for administration. Their routine use is not advocated by IPC. It has been suggested that the use of non ported cannulas is preferable to ported ones due to the theoretical increased risk of infection, tissue pressure injuries and dislodgement.

One photograph shows the cannula over the wrist joint and with the wrist band over the top of the cannula – ideally a cannula should be in a naturally “splinted” area to avoid mechanical and phlebitis issues

One photograph shows a doctor with a stethoscope around her neck. This is not advocated by IPC.

- **Saving Lives and WHO Recommendations**

Saving Lives High Impact Interventions (Care Bundles) with regard to IV cannulation practices and WHO 5 Moments for Hand Hygiene are not mentioned in the module, but must be incorporated into practice.

- **Technical Information**

Access to a BNF or the [Injectable medicines guide](#) may be required to assist with one technical question re vancomycin, which assumes some prior knowledge.

It should be noted that a bespoke electronic training package is under development for NUTH.

1.2 Competence

Permanent Trust staff must complete the relevant training and accreditation required by their professional body before giving any injectable medication. Once this has been achieved practitioners may administer any injectable medicine with the exclusion of cytotoxic medicines. Additional competencies are required for the administration of cytotoxic medicines and for the use of devices.

Prescribing competence (including independent and supplementary prescribing) is detailed in the [Medicines Policy](#).

New non medical staff, regardless of profession, should be signed off as competent for preparation, administration and monitoring of injectable medicines by a senior practitioner in their clinical area who is also competent in the procedure. This sign off should take the form of a suitably completed Trust Training pack and competency assessment for the Preparation, administration and monitoring of intravenous drugs.

A record of training and competence of staff should be kept in the clinical area and recorded on ESR. This will be monitored as part of the auditing process.

Junior doctors (F1) undertake a competency assessment of preparation and administration of an injectable medicine during this training year.

1.3 Patient Self Administration of Injectable Medicines

In designated directorates, patients and their carers may be trained to self administer injectable medicines. In such cases the patient / carer should be assessed as suitable to self administer, trained and competency assessed in the relevant methods of preparation, administration and monitoring using Trust approved documentation.

2. General Information for Injectable Medicines.

2.1 Risks

The main risks associated with injectable medicines have been identified by the NPSA as follows:

- Non-availability to clinical staff, at the point of use, of essential information about injectable medicines. Such information may not be included in the manufacturer's pack or in commonly available reference sources.
- Incomplete and ambiguous prescriptions which don't include complete details of the solution to be used to dilute the injectable medicine (diluent), final volume, final concentration or intended rate of administration.

- Presentations of injectable medicines that may require complex calculation, dilution and handling procedures before the medicine can be administered
- Selection of the wrong medicine or diluent.
- Use of a medicine or diluent or infusion after its expiry time and date.
- Calculation errors made during prescription, preparation, administration of the medicine, leading to administration of the wrong dose and/or at the wrong concentration or rate.
- Incompatibility between diluent, infusion, other medicines and administration devices.
- Administration to the wrong patient.
- Administration by the wrong route.
- Unsafe handling or non compliance with aseptic non touch technique (ANTT) leading to contamination of the injection and harm to or infection of the patient.
- Health and safety risks to the operator or environment.
- Variable levels of knowledge, training & competence amongst healthcare practitioners.

2.2 Indications for Injectable Medicines

- To maintain fluid/electrolyte balance in patients unable to take fluids by mouth.
- To achieve high and predictable drug levels e.g. antibiotics in life threatening infections.
- For patients whose gastrointestinal tract has to be rested e.g. patients with non-functioning or inadequately functioning gastrointestinal tracts, or following gastrointestinal surgery.
- To patients who cannot tolerate drugs by mouth e.g. if vomiting or unconscious.
- When the drug is broken down in, or not absorbed from, the gastrointestinal tract e.g. insulin.
- When the drug is not available in an oral formulation.
- As a sedative when a rapid response is required.

3. General Information - Intravenous Route

Advantages of the Intravenous Route

- The drug reaches the systemic circulation with a minimum of delay. This is important in acute situations when speed of response is essential.
- Large quantities of fluid can be given over a long period of time by means of a constant infusion.

.Disadvantages of the Intravenous Route

- Once injected there is no recall and reversal may be difficult, and often impossible.

- Too rapid an injection may cause adverse effects. Safety demands that bolus IV injections should be given over a minimum of 3-5 minutes, unless otherwise indicated
- Anaphylactic and other hypersensitivity reactions may be severe. (In such cases the algorithm from Resuscitation Council should be followed and can be found on page 20 of [Emergency medical treatment of anaphylactic reactions for first medical responders and for community nurses](#).)
- Danger of embolism from particulate matter, or air that may inadvertently be introduced by this route
- Hypertonic solutions may cause agglutination of red blood cells, thrombophlebitis or other life threatening complications
- Extravasation of some drugs may cause tissue damage
- Infection by microbial contaminants if ANTT is not used, or from micro-organisms colonising the intravenous catheter.
- Injectable presentations of drugs that can be given by other routes (orally, rectally etc), are usually more expensive. In such cases the drug should only be given parenterally when the other alternative routes are not clinically appropriate.

3.1 Intravenous Bolus/IV Push

This method is used when a rapid response or high serum concentration is required. The drug and diluent are injected directly into the bloodstream via a peripheral cannula or a central venous catheter. Lines used to administer bolus intravenous medication should be single use and staff must ensure that any completed infusions are discarded immediately.

Rate of Injection

3.1.1 Slow Bolus Injection The majority of drugs that are given by IV bolus, need to be injected over a period of several minutes (typically 3 to 5 minutes). Practitioners should refer to product literature, and the information in this document, and use the recommended injection time. If no specific information is available, it is recommended that a slow bolus is given over a period of greater than 5 minutes.

3.1.2 Rapid Bolus Injection A very small number of drugs need to be given as a rapid intravenous bolus e.g. adenosine, and some radiological contrast injections. In these cases the rapid injection should be followed by a rapid flush of a recommended flush solution that is compatible with the drug.

3.2 Intermittent Intravenous Infusion: (I) IV Infusion

This refers to an infusion which is usually administered over a period of typically between 10 minutes and 2 hours, but can be longer. It is used as an alternative to bolus administration for regular dosing, and when slow administration or greater dilution is required to avoid toxicity. Lines used to administer intermittent

intravenous medication should be single use and staff must ensure that any completed infusions are discarded immediately.

3.2.1 Intermittent Infusion Administration via a Burette Set

This method is ONLY recommended where potential hazards of an open system are outweighed by the requirements for complex drug additions, dilutions, or use of infusion volumes not available in standard infusion bags. All burette set use within the Trust should be risk assessed. The principal hazards to consider are:-

- Burettes are open systems having an air inlet on the burette chamber and so have increased potential for microbial contamination.
- Using the burette for more than one drug increases the chance of incompatibilities – it is recommended that a separate burette is used for each drug.
- Sequential drug additions will result in a change in the contents of the burette with time and will create labelling problems – again it is best to use one burette per drug.
- Thorough mixing within the burette chamber is difficult.

3.3 Continuous Intravenous Infusion: (C) IV Infusion

This is an infusion intended to be given, over a longer period, at a constant or variable rate. A continuous infusion is used where a consistent or controlled therapeutic response is required. It may also be used to permit greater dilution, than is usually possible with an intermittent infusion, and in order to avoid toxicity.

- The Saving Lives project in this Trust requires intravenous lines containing clear fluid (simple intravenous solutions without any medicine added to them), to be changed after 72hrs. Continuous intravenous infusions of medicines change every 24hrs. The start date and time should be clearly indicated on the labels provided. Any disconnection required should be brief and using ANTT. The line should be changed if this cannot be guaranteed. Where blood products are involved see [Blood Transfusion Policy](#).

4 General Information - Intramuscular Route

Intramuscular injection is a less efficient method of parenteral administration than the intravenous route. This is because there is a slower onset of action because the proportion of drug that enters the circulation quickly is smaller than occurs with an intravenous drug, and the proportion of drug that is absorbed is unreliable and often incomplete. For some agents this will be a disadvantage e.g. antibiotics, but for others these characteristics are advantageous e.g. those which require a delayed onset of absorption, e.g. depot injections, vaccines. The intramuscular route has the extra advantage of being easily accessible, particularly in situations where IV administration is not practical due to lack of access or in an uncooperative patient. Finally, intramuscular injection maybe the only option for drugs, that cannot be formulated for intravenous administration.

Intra-muscular injections should be avoided in patients treated with anticoagulant therapy (warfarin, heparin etc). Where an intra-muscular injection is used in such patients there must be valid clinical reasons why no other route can be used and the prescribing clinician must be aware of the patient's current international normalised ratio (INR) status.

Intramuscular injections should not be administered to those with thrombocytopenia or other bleeding disorders without specialist advice.

Recommended Sites for Intramuscular Injection

Intramuscular injections should be administered in a number of specific sites depending on the nature of the product being given. Although a 21 gauge needle should always be used when giving an IM injection to an adult, the needle should be inserted less deeply in cachectic or thin patients. Skin cleansing should occur as directed by [Trust guideline](#).

Adults

- Mid-deltoid - Useful if a more rapid response is desirable. The denser part of the deltoid, approximately 2.5cm down from the acromial process, must be used. Injection volume must not exceed 1ml and the area should not be used repetitively.
- Dorsogluteal (commonly referred to as the outer upper quadrant) - Used for Deep IM and Z-Track injections. This area has the slowest drug absorption rate, and is likely to be atrophied in non-ambulant and emaciated patients. Care must be taken to ensure that the injection does not hit the sciatic nerve or the superior gluteal arteries. In adults up to 4 ml can be safely injected into this site.
- Ventrogluteal (gluteus medius) Used for Deep IM and Z-Track injections.
- Rectus Femoris (anterior muscle of the quadriceps) – Useful for standard injections, deep IM, Z-Track, and injections in oil. It is the preferred site for infants and for self administration. In adults between 1-5ml can be injected.
- Vastus Lateralis (part of the quadriceps femoris located on the lateral side of the femur) – This is often the site of choice for standard deep or Z-track intramuscular injections. It is a large muscle and can accommodate repeated injections. Up to 5mls can be safely injected into this site.

The Z-track method involves pulling the skin downwards or to one side of the injection site and inserting the needle at a right angle (90 degree angle) to the skin thus moving the cutaneous and subcutaneous tissues by approximately 2-3 cm. The medication is injected slowly (1ml per second), held in place for 10 seconds and the needle withdrawn, while releasing the retracted skin at the same time. This manoeuvre seals off the puncture tract.

Children (Medicines for Children 2003)

- Vastus Lateralis - Recommended for children less than 5 years old
- Rectus Femoris – Alternative in children less than 5 years
- Dorsogluteal site – is safe in children of 5 years or older, so long as care is taken to avoid the sciatic nerve.

- Deltoid muscle – this is small in infants and is best avoided if possible, but it can be used in older children and adolescents.

5. General Information - Subcutaneous Route

The subcutaneous route of administration is used for drugs which require a slower rate of absorption than achieved intravenously, but faster and more efficient than intramuscular. It also has the benefit of being a less painful site for injection, and is suitable for administration of larger volume solutions by continuous infusion. It is the favoured route to administer maintenance insulin therapy and for symptom management in palliative care. Suitable sites for injection include the lateral aspects of the upper arms and thighs, the abdomen in the umbilical region, the back, the lower loins and may be defined within the technical product information.

6. Other routes of Injectable Administration

6.1 Epidural

The following information is to be used in conjunction with Trust Epidural policies. An epidural infusion is an infusion that is given into the epidural space to provide pain relief, most frequently in the peri-operative period or during labour. The positioning of the epidural catheter will determine the extent of the nerve block.

Intra-operatively, the epidural infusion will be initiated in theatre by the anaesthetist or a designated anaesthetic assistant on instruction from the anaesthetist. A Trust approved epidural prescription chart must be completed by an appropriately qualified prescribing practitioner (usually an anaesthetist) for all epidural infusions.

There must be close monitoring of the patient, appropriate to the clinical circumstances, throughout the period of continuous epidural analgesia. Generally this will include monitoring the epidural site, sensory level, motor block as per instructions on the Trust Epidural Infusion prescription chart.

A designated epidural pump must be used for all epidural infusions. The pump must be clearly marked with the words “For epidural use only”.

A designated administration set and line must be used with yellow colouring to distinguish them from other administration lines. The line must be labelled with an “epidural” sticker.

The infusion bag must be clearly labelled “For epidural use only”.

(The NPSA has issued a [Patient Safety Alert \(Part b\)](#) which requires that from 1 April 2013 all epidural, and regional infusions and boluses are performed with devices that use safer connectors that will not connect with intravenous Luer connectors or intravenous infusion spikes – this will be introduced as equipment becomes available from manufacturers).

A suitably competent individual i.e. an anaesthetist, an Acute Pain Service nurse or a designated anaesthetist assistant responsible for epidurals in the delivery suite, must perform changing of the infusion bag or infusion rate on the epidural pump. All changes to an epidural infusion must be recorded on the designated epidural chart.

Problems with the epidural infusion or the infusion pump must be referred urgently to the appropriate individual, i.e. Acute Pain Service, the first on call anaesthetist or designated anaesthetic staff.

All staff involved in epidural therapy must be aware of the Trust guidelines for skin antisepsis prior to neuraxial blockade, must attend the Trust training on use of epidural in a clinical area regularly and complete the necessary competencies as set out by the pain team.

6.2 Intrathecal Administration

The preparation, administration and monitoring of *cytotoxic* medication by the intrathecal route is very carefully controlled as is required by national Department of Health Guidelines available on the Trust intranet. All preparation must occur within the pharmacy and prescribing, administration and monitoring is performed by designated practitioners on a Trust register.

In the case of *non cytotoxic* intrathecal preparation, risks associated with this route of administration should be considered when deciding the most appropriate location for preparation. Preparation of intrathecal injections (non cytotoxic only) is permitted in theatre and critical care areas; however, preparation within the pharmacy is preferred whenever the stability of the medicine allows.

Where a preparation has been assessed during the approval process as being suitable for preparation within the clinical area, this preparation and administration must always be performed by or under the direct supervision of a consultant / specialist registrar who is competent in the technique.

Nurse Practitioners who have been appropriately trained may refill an intrathecal drug pump reservoir. The injectable medicine used to refill the pump should be prepared within the pharmacy wherever the stability allows.

(The NPSA has issued a [Patient Safety Alert \(Part A\)](#) which requires that from 1 April 2011 all spinal (intrathecal) bolus doses and lumbar puncture samples are performed using syringes, needles and other devices with connectors that will not also connect with intravenous Luer connectors – this will be introduced as equipment becomes available from manufacturers).

6.3 Other spinal routes

Specialist areas may require the use of other spinal routes (e.g. paravertebral). Where preparation is assessed as suitable to occur in the specialist clinical area,

this should always be under the direct supervision of a consultant / specialist registrar who is competent in the technique to be performed.

6.4 Intra-arterial

This is an increasingly utilised, specialised therapeutic technique whereby an arterial catheter is placed in the appropriate artery. The majority of such procedures are performed by interventional radiologists or cardiologists and performed entirely within the angiographic labs according to specific protocols. These include the direct injection of vasodilators and thrombolytic agents during arterial recanalisation. In addition, various chemotherapeutic treatments are more effective by the arterial route and may be administered through intermittent catheterisation or by placement of subcutaneous ports. Bland arterial embolisation with non-absorbent particles or histoacryl glue is a very important method of both tumour control and the emergency treatment of haemorrhage in every part of the body.

All such injections should be performed in accordance with the principles outlined in sections 7 and 8 regarding prescription and preparation of injectable medicines. In some instances the patient may return to the ward with a syringe pump attached to the catheter for slow administration of the infusate over 24 hours. The standard policies for control of such devices should be applied (section 10).

Accidental intra-arterial injection of drug may result in serious adverse effects. Consequently there are very few drugs which are recommended for intra-arterial injection. Practitioners should not purposefully use this route other than in the circumstances outlined above, and should be vigilant when giving intravenous drugs to a patient who has an arterial cannula in situ.

6.5 Miscellaneous

A number of other routes of injectable administration are used in specialist clinical areas. These include:

- Intraperitoneal injection
- Injection by way of implanted central venous access devices
- Intraventricular injection
- Intraosseous injection
- Intraocular injection
- Assorted localised nerve blocking injections
- Intra articular injection and soft tissue injections
- Intrahepatic
- Intravesical
- Endoscopic submucosal

As with all injectable procedures, practitioners should not administer medication by any of these routes unless they have undergone appropriate specialist or local training, and have demonstrated competence in the specific technique. The

specialist areas should have Trust approved protocols to support their administration practices.

7. Preparation of Injectable Medicines

7.1 General Procedure for Aseptic Non Touch Technique (ANTT) to be used in Clinical Areas

- *Read all prescription details carefully & confirm that they relate to the patient to be treated.*
- Ensure that the area in which the medicine is to be prepared is as clean, uncluttered and as free from interruption and distraction as possible (e.g. treatment room in most clinical areas.)
- Clean Hands following Hand Hygiene Policy.
- Use an alcohol wipe to disinfect the surface of the reusable plastic tray as per ANTT. Areas designated by Infection Prevention and Control to use disposable trays **must** also perform this important step.
- Assemble everything you need: Sharps bin for waste disposal, medicine ampoule(s)/vial(s), diluent, syringe(s), 21g, 23g, 25g needle(s), 2% chlorhexidine gluconate in 70% isopropyl alcohol swabs, disposable protective gloves, clean re-usable plastic tray (some areas have been designated by Infection Prevention and Control to use disposable trays).
Check:
 - Packaging and containers for expiry dates and damage.
 - If medicines were stored as recommended e.g. in the 'fridge.
- Beware of the risk of confusion between similar looking medicine packs, names & strengths: read all labels carefully.
- Check that:
 - The formulation, dose, diluent, infusion fluid and rate of administration correspond to the prescription and product information.
 - The patient has no known allergy to the medicine
 - You understand the method of preparation.
- Calculate the volume of medicine solution needed to give the prescribed dose. Write the calculation down and have it checked by another person. It is recommended that the checker performs the calculation independently, and then confirms the answer with the operator.

- Prepare the label for the prepared medicine (see standard 1.3.3)
- Don disposable apron.
- Clean hands according to [Trust Hand Hygiene policy](#). Adhere to “bare below the elbows” in accordance with the [Trust Dress, Appearance and Uniform Policy](#).
- Put on a pair of disposable protective gloves
- Assemble the syringe(s) and needle(s): Protecting key parts, peel open wrappers carefully and arrange all ampoules/vials, syringes and needles neatly in the tray.
- Most injectable medicines are licensed for “once only” use. This includes bags of infusion fluids which should not be used to prepare multiple injectable medicines.
- Use an aseptic non-touch technique i.e. avoid touching areas where bacterial contamination may be introduced, e.g. syringe-tips, needles, vial tops. Never put down a syringe attached to an unsheathed needle.
- Prepare the injection by following the manufacturer’s product information or local guidelines.
- **Ensure that the process has been independently checked by a second registered practitioner.**
The second checker must ensure that all calculations, preparation (including choice of diluents, confirmation of correctly measured volumes) and labelling have been performed in line with the injectable medicines policy and the supporting information contained in this document.

7.2 Withdrawing solution from an ampoule (glass or plastic) into a syringe

- Tap the ampoule gently to dislodge any medicine in the neck.
- Clean the neck of the ampoule using an alcohol wipe (Glass ampoules only). Allow to dry.
- Snap open the neck of glass ampoules, using an ampoule snapper if required.
- Attach a needle (use the minimum appropriate size bore for plastic or a filter straw for glass) to a syringe and draw the required volume of solution into the syringe. Tilt the ampoule if necessary.

- Invert the syringe and tap lightly to aggregate the air bubbles at the needle end. Expel the air carefully.
- Remove the needle from the syringe and fit a new needle or sterile blind hub.
- Label the syringe according to the Injectable Medicines Policy.
- Keep the ampoule and any unused medicine until administration to the patient is complete.
- If the ampoule contains a suspension rather than solution, it should be gently swirled to mix the contents immediately before they are drawn into the syringe.

7.3 Withdrawing a solution or suspension from a vial into a syringe

- Remove the tamper-evident seal from the vial and wipe the rubber septum with a 2% chlorhexidine gluconate in 70% isopropyl alcohol wipe. Allow to dry for at least 30 seconds.
- With the needle sheathed, draw into the syringe a volume of air equivalent to the required volume of solution to be drawn up.
- Remove the needle cover and insert the needle into the vial through the rubber septum.
- Invert the vial. Keep the needle in the solution and slowly depress the plunger to push air into the vial.
- Release the plunger so that solution flows back into the syringe.
- If a large volume of solution is to be withdrawn, use a push-pull technique: repeatedly inject 5-10ml of air and draw up an equal volume of solution until the required total is reached. This “equilibrium method” helps to minimise the build-up of pressure in the vial.
- Alternatively, the rubber septum may be pierced with a second needle to let air into the vial as solution is withdrawn. The tip of the vent needle must always be kept above the solution to prevent leakage.
- With the vial still attached, invert the syringe. With the needle & vial uppermost, tap the syringe lightly to aggregate the air bubbles at the needle end. Push the air back into the vial.

- Fill the syringe with the required volume of solution then draw in a small volume of air. Withdraw the needle from the vial.
- Expel excess air from the syringe. Remove the needle and exchange it for a new needle or a sterile blind hub.
- The vial(s) and any unused medicine should be kept until administration to the patient is complete.
- If the vial contains a suspension rather than solution, it should be gently swirled to mix the contents, immediately before they are drawn into the syringe.

7.4 Reconstituting powder in a vial and drawing the resulting solution or suspension into a syringe

- Remove the tamper-evident seal from the vial and wipe the rubber septum with a 2% chlorhexidine gluconate in 70% isopropyl alcohol wipe. Allow to dry for at least 30 seconds.
- Use the procedure in 7.2 above to withdraw the required volume of diluent (e.g. water for injections or sodium chloride 0.9%) from ampoule(s) into the syringe.
- Inject the diluent into the vial. Keeping the tip of the needle above the level of the solution in the vial, release the plunger. The syringe will fill with the air which has been displaced by the solution. (If the contents of the vial were packed under a vacuum, solution will be drawn into the vial and no air will be displaced). If a large volume of diluent is to be added, use a push-pull technique (see above).
- With the syringe and needle still in place, gently swirl the vial to dissolve *all* the powder, unless otherwise indicated by the product information. This may take several minutes.
- Follow the relevant steps in 7.3 above to withdraw the required volume of solution from the vial into the syringe.
- Alternatively, the rubber septum may be pierced with a second needle to let air into the vial as solution is withdrawn. The tip of the vent needle must always be kept above the solution to prevent leakage.
- If a purpose-designed reconstitution device is used, the manufacturer's instructions should be read carefully and followed closely.

7.5 Adding a medicine to an infusion

- Prepare the medicine in a syringe using one of the methods described in 7.2 to 7.4 above.
- Check the outer wrapper of the infusion container is undamaged. 7.1 Remove the wrapper and check the infusion container itself in good light. It should be intact and free of cracks, punctures/leaks. Where applicable, the tamper evident seal should be in tact.
- Check the infusion solution which should be free of haziness, particles and discolouration.
- (Where necessary),remove the tamper-evident seal on the additive port according to the manufacturer's instructions or wipe the rubber septum on the infusion container with a 2% chlorhexidine gluconate in 70% isopropyl alcohol wipe and allow to dry for at least 30 seconds.
- If the volume of medicine solution to be added is more than 10% of the initial contents of the infusion container, (more than 50ml to a 500ml or 100ml to a 1litre infusion), an equivalent volume must first be removed with a syringe and needle.
- Inject the medicine into the infusion container through the centre of the injection port, taking care to keep the tip of the needle away from the side of the infusion container. Withdraw the needle and invert the container at least five times to ensure thorough mixing before starting the infusion.
- Do not add anything to any infusion container other than a burette when it is hanging on the infusion stand since this makes adequate mixing impossible.
- Before adding a medicine to a hanging burette, administration must be stopped. After the addition has been made and before administration is re-started, the contents of the burette must be carefully swirled to ensure complete mixing of the contents.
- Check the appearance of the final infusion for absence of particles, cloudiness or discolouration.
- Label the infusion

7.6 Further diluting a medicine in a syringe for use in a pump or syringe-driver.

This describes the procedure to be used where further dilution is required and one larger syringe cannot be used as the active medicine volume may be small (e.g. insulin).

- Prepare the medicine in a syringe using one of the methods described above.
- Draw the diluent into the syringe to be used for administration by the pump or syringe-driver. Draw in some air (slightly more than the volume of medicine needed) and remove the needle.
- Stand the diluent syringe upright. Insert the needle of the syringe containing the medicine into the tip of the diluent (administration) syringe and add the medicine to it. Alternatively, a disposable sterile connector may be used to connect two syringes together directly.
- Two practitioners must check that:
 - The total volume of injection solution in the syringe is as specified in the prescription and that the infusion can be delivered at the prescribed rate by the administration device chosen.
 - The rate of administration is set correctly on the administration device and according to the manufacturer's instructions.
- Fit a blind hub to the administration syringe using ANTT and invert several times to mix the contents.
- Remove the blind hub. Tap the syringe lightly to aggregate the air bubbles at the needle end. Expel the air and refit the blind hub.
- Carefully check the syringe for cracks and leaks and then label it (see standard 3.3.3, noting especially the requirements specific to syringe drivers)
- Check that the rate of administration is set correctly on the device before fitting the syringe, priming the administration set and starting the infusion device.

7.7 Labelling injection and infusion containers

- All injections should be labelled immediately after preparation, except for a single syringe intended for immediate push (bolus) administration, where the syringe has not left the hands of the person who prepared it. Under no circumstances, however, must an operator be in possession of more than one unlabelled syringe at any one time, nor must an unlabelled syringe be fitted to a syringe driver or similar device.
- Place the final syringe or infusion and the empty ampoule(s)/vials(s) in a clean plastic/ smooth disposable tray for transport to the bedside, with the prescription, for administration.

8. Administration of Injectable Medicines

General Information for all Routes

The General Procedure given below should be followed during the administration of any injectable medicine.

The hands must be decontaminated according to [Trust Hand Hygiene Policy](#) immediately before administration of the drug. Gloves should be worn. Bare below the elbow must be observed

8.1 Before administering any injection

8.1.1 Check all the following:

- patient's name, hospital/ NHS number or date of birth or address
- prescriber's signature or that a PGD applies
- the approved medicine name
- the dose and frequency of administration
- the date and route of administration
- the allergy status of the patient
- the expiry date / time of the medicine

8.1.2 Also check, where relevant:

- Access route chosen is appropriate for the medicine
- brand name and formulation of the medicine
- concentration or total quantity of medicine in the final infusion container or syringe
- name and volume of diluent and/or infusion fluid
- rate and duration of administration
- type of rate-control pump or device(s) to be used
- the age and weight of any patient under 16 years of age, where relevant
- date on which treatment should be reviewed

Ensure that an independent check has been performed by a registered practitioner.

The independent checker must ensure that the following are all correct:

- Patient identity and allergy status.
- Prescription relates to the patient.
- Prepared injectable medicine matches the prescription.
- The rate control device is suitable and set up appropriately (check calculation), or confirm that no rate control device is required.
- Access route chosen is appropriate.

8.1.3 Check that the medicine is due for administration at that time and has not already been given.

8.1.4 Assemble everything you need including any flushing solution(s) needed and / or specialist giving set.

8.1.5 Explain and discuss the procedure with the patient.

8.1.6 Check any infusion already in progress: it should be should be free of haziness, particles and discolouration.

8.1.7 Check that an appropriate access device is in place. Flush it immediately before and after administration of a medicine, and between doses of different medicines administered consecutively. Also check the administration site for signs of leakage, infection or inflammation.

8.2 Administration of injections: general

8.2.1 Check infusions: they should be should be free of haziness, particles and discolouration.

8.2.2 Use aseptic non-touch technique at all times.

8.2.3 Spike infusion containers carefully, on a flat surface, using the technique appropriate to the type of container.

8.2.4 Prime the access device according to local policy immediately before starting an infusion

8.2.5 Before adding a medicine to a hanging burette, administration must be stopped. After the addition has been made and before administration is re-started, the contents of the burette must be carefully swirled to ensure complete mixing of the contents.

8.3 After administration

8.3.1 After completion of an intermittent infusion, flush the access device.

8.3.2 Ask the patient to report promptly any soreness at the injection site or discomfort of any sort.

8.3.3 Make a detailed record of administration.

- Discard the empty ampoules/vials from which the injection was prepared and any unused medicine in them according to the Waste Policy: ampoules or vials should never be used to prepare more than one injection unless labelled by the manufacturer for “multi-dose” use (see standard 3.2.4).
- Re-usable trays must be decontaminated with a universal sanitising wipe and allowed to dry thoroughly after each use. Disposable trays must not be reused.

- All re-usable trays must be washed with hot water and detergent, rinsed and dried, on a weekly basis.

8.3.4 Re-check the administration site for signs of leakage, infection or inflammation and continue to monitor the patient, contents of the infusion container and the rate of infusion according to local policy.

8.4 Extra Practical Considerations for the Administration of Intravenous Bolus injections.

Following the performance of the independent second check, described in 8.1.2, intravenous bolus injection(s) may be administered by a single registered practitioner.

- The insertion site must be checked for signs of inflammation or phlebitis before giving the drug. Re-site cannula if any signs are present. The observation should be documented on a peripheral cannulation assessment sticker three times a day in accordance with the Trust [Insertion and Management of Peripheral Intravenous Cannulae Policy](#).
- The injection port is a key part and must be cleaned using a 2% chlorhexidine gluconate in 70% isopropyl alcohol swab for a peripheral line, or a central line. When using swabs impregnated with a cleansing solutions the area should be left to air dry completely before proceeding. This will take up to 30 seconds. (Do not blot or wipe dry).
- Unless patency is already established, the patency of the vein must be checked by flushing with 1 to 2ml of sodium chloride 0.9% (unless contraindicated), or a smaller volume in children, dependent on the size of the cannula in use.
- The drug should be injected using a needle free system wherever possible. Where a needle is required, the smallest appropriate gauge should be used. Administration with a needle through a rubber bung or membrane reduces infection risk compared to removing the cap on the port and connecting the syringe directly to it.
- For small volume bolus injections it is advisable to dilute, where appropriate, to a larger volume (typically 2 to 5ml, but smaller volumes may be more acceptable for children and some specialist areas) with a compatible fluid. Such dilutions should be prescribed. This will make it easier for the practitioner to control the rate of injection more accurately.
- The drug must be given over the recommended time as prescribed or as stated in the [Injectable Medicines Guide](#) or product literature. Always time with a watch or clock and observe the cannula site for phlebitis, or extravasation, and the patient for signs of pain or discomfort.
- Following the injection, flush the cannula with a compatible fluid (see [Injectable Medicines Guide](#)) or product literature for guidance) using the same rate of administration as the original injection.
- Discard the empty ampoules/vials from which the injection was prepared and any unused medicines in them: in accordance with the [Trust Waste Management Policy and Procedures](#). Ampoules of vials should never be

used to prepare more than one injection unless labelled by the manufacture as “multi-dose”.

8.5 Extra Practical Advice for Administration of intermittent Intravenous Infusions

- The cannula site must be checked for signs of inflammation or phlebitis before giving the drug. Re-site cannula if any signs are present.
- The port where the solution set is to be connected must be cleaned using a 2% chlorhexidine gluconate in 70% isopropyl alcohol swab for a peripheral or a central line. The swabbed site should always be allowed to dry before the connection is made.
- The patency of the vein must be checked by flushing with 1 to 2ml of sodium chloride 0.9%, or a smaller volume in children, dependent on the size of the cannula in use.
- Volumes given by intermittent infusions vary considerably. See the Injectable Medicines Guide or product literature for suitable volumes. Use the volume recommended unless otherwise specified on the drug chart. For volumes 50ml or less, a syringe pump may be used.
- If intermittent infusions of more than one drug are to be administered consecutively, always confirm that the drugs being given are compatible with each other and the infusion fluid and its contents. This is to prevent the possibility of the drug(s) and/or the diluent becoming inactive or changed due to a chemical or physical reaction. If this compatibility is not confirmed then you should either flush between infusions or replace the giving set between each drug administration.

Where the infusion is to be given directly through the cannula:

- Connect the solution set to the venous access device and administer the infusion. IPC advocate that the use of non ported cannulas is preferable to ported ones due to the theoretical increased risk of infection, tissue pressure injuries and dislodgement. It is therefore recommended that a short extension or a bionectar is used.
- Afterwards flush the venous access device with a compatible solution at a rate similar to that used for the original drug. The flush will usually be sodium chloride 0.9%; however you should confirm this in the injectable medicines guide or product literature before proceeding. In peripheral cannulae, the flush acts as the “lock”.
- The solution set should be disconnected from the cannula and discarded immediately.

Where a primary infusion exists:

- Check the compatibility of primary infusion with the drug(s) and diluent fluid(s) of the intermittent infusion.
- Individually prepared solutions should be administered over not more than 24 hours (or the specific drug expiry time if this is shorter). Partly used infusions

8.5.1 Extra Practical Considerations for Administration when using a Burette Set for an Intermittent Infusion

- Use a needleless system for administration through an injection membrane on the burette or giving set.
- The burette chamber air filter must never be allowed to get wet. If it does the system will not function and infusion flow will be interrupted.
- When diluting in the burette chamber always add the diluent before the drug solution and mix thoroughly with all clamps closed.
- After mixing check the solution for clouding or particles.
- Always fix a completed drug additive label to the burette chamber when adding the drug. Be sure that the label covers any previously cancelled labels.
- When the contents of burette have run through, cancel the drug added label.
- If the drug requires protection from light cover burette appropriately.
- If other drugs or fluids are running through the cannula or line, check that everything is compatible and use a Y-connector (preferred) or a 3-way tap (higher risk of infection). Consider if a separate intravenous access is necessary.

8.6 Extra Practical Considerations for Administration of Continuous Intravenous Infusions

- The cannula site must be checked for signs of inflammation or phlebitis before giving the drug. Re-site the cannula if any signs are present.
- The port where the solution set will be connected must be cleaned using 2% chlorhexidine in 70% isopropyl alcohol swab for a central line or peripheral line. The swabbed site should always be allowed to dry before the connection is made.
- The patency of the vein must be checked by flushing with 1 to 2ml of sodium chloride 0.9%, or a smaller volume in children, dependent on the size of the cannula in use.
- Volumes given by continuous infusion vary considerably. See the [Injectable Medicines Guide](#) or product literature for suitable volumes. For volumes of 50ml or less, a syringe pump may be used.
- Where drug administration requires simultaneous use of two compatible continuous infusions, use a separate solution set for each, connected using a Y-connector (preferred), or a 3-way tap (greater risk of infection). It is essential that practitioners confirm that the drugs being given are compatible with each other and the infusion fluid and its contents. This is to prevent the possibility of the drug(s) and/or the diluent becoming inactive or changed due to a chemical or physical reaction. If this compatibility is not confirmed then you must not give the drugs together and instead infuse each individually via separate cannulae or catheter lumens.

- If an infusion is discontinued the line should be left clamped off, but still connected, until the next line change (preferred practice). Alternatively if the solution set is disconnected, the cannula must be re-capped with a new sterile bung, and the drug and solution set discarded.
- Individually prepared solutions given by continuous infusion should be administered over a maximum period of 24 hours (or the specific drug expiry time if this is shorter). Partly used infusions fluids must be discarded. Once they have been disconnected from the giving set; reuse must never be permitted.

8.7 Extra Practical Considerations for the Administration of Intramuscular Injections.

Intramuscular injections should be given only with extreme caution to patients receiving anticoagulants or those with thrombocytopenia or other bleeding disorders (see 4.0).

- If a needle is used to draw up the medicine, this should be replaced prior to administration to avoid the solution on the wet needle irritating the needle track. A 21G needle (or smaller bore if recommended) should be used to administer the medication.
- Before injecting the solution, the syringe plunger should be slightly withdrawn to check whether the needle has entered a blood vessel. If blood is withdrawn, another site must be chosen.
- Because intramuscular injections can damage muscles and leave scars, injection sites should be regularly inspected, particularly in the immobile and very sick.

8.7.1 Additional administration information can be found in Chapter 11 of the [Royal Marsden Manual](#).

8.8 Extra Practical Considerations for Administration of Subcutaneous Injections

- Ensure that, where appropriate, the section “other charts in use” on the inpatient prescription chart is also completed.
- Skin preparation: Where appropriate prepare site with 2% chlorhexidine gluconate in 70% isopropyl alcohol wipes, allow to dry prior to insertion of cannula.
- Due to the high risk of local reactions and irritation, particularly with repeated injections, Particular attention should be made to the regular inspection of the injection sites.

Subcutaneous Bolus Injection

- The volume of a single subcutaneous injection should be as small as possible, and should ideally be 1 ml, or less, in an adult patient (for children

seek specialist advice locally). If the volume is higher consider using a different route of administration or injecting at more than one site.

- Pre-filled syringes are available for a number of subcutaneous medications, e.g. heparins. Many of these devices contain a small quantity of air in the injection which is placed there to ensure that the total dose of medication is expelled from the syringe at injection. This air must be retained in the syringe; otherwise there is a risk of the patient receiving a smaller dose of drug than intended.

Subcutaneous Infusions

- Transparent adhesive dressing should be used to secure the cannula and allow observation of the entry site. The use of tape is not advocated but could be used to secure the administration line to reduce the pressure of pulling on the infusion set. Care must be taken to ensure that visibility of the site is not impaired.
- Subcutaneous infusions can also be given at a wide range of infusion rates up to a maximum of 1ml/kg/hr in an adult patient.
- In the interest of patient safety, comfort and independence it is recommended that whenever possible the infusion set be removed between fluid replacement infusions.

8.8.1 Additional administration information can be found in Chapter 11 of the [Royal Marsden Manual](#).

9. Monitoring of Injectable Medicines

The standards as defined in section 1.5 of the [Injectable Medicines Policy](#) should be adhered to. Further information relevant to the standard statements is given below:

It should be noted that bandaging of injections sites is not recommended as this prevents effective monitoring of the injection site. (Transparent tape is permitted.) Where bandaging is unavoidable, this should be performed in a way which will allow the injection site to be observed whilst still securing the cannula.

Where no specific requirements for the drug being infused are advised by the product literature or [Injectable Medicines Guide](#), the following minimum requirement should be performed in all clinical areas within the Trust. It is anticipated that some clinical areas will need to exceed this minimum requirement.

- **Active infusions** are considered to be those infusions which have had additions made in the clinical area, or are high risk injectables which have been prepared in pharmacy. These should be monitored as described below **at least hourly** and documented on the Trust Infusion Check Chart for Active Intravenous Infusions. If a prescriber designates that monitoring is required less frequently, their signature is required on the Trust Chart.

- **Inactive** (simple infusion fluids) should be monitored as clinically appropriate for the patient with a minimum standard of **four hourly**. This should be documented on the Fluid Balance Chart.

Monitoring the patient

- **Identification:** confirm according to the local patient identification policy.
- **Condition of the patient:** Ensure that there are no signs that the patient's condition is worsening. If the patient is conscious ask if they are experiencing any pain or discomfort around the site. This could be an early sign of a problem.

Monitoring the cannula and infusion Site

- **Redness:** Redness around the site can indicate an occlusion in the cannula, the presence of phlebitis or extravasation of infusion fluid into the skin. Removal and resiting of the cannula would be advised.
- **Location:** Ensure the cannula remains in the vein. Extravasation (see section 10.3) and infiltration of surrounding tissue could result if the cannula becomes dislodged.

Monitoring the administration set

- **Line:** This should be correctly labelled.
- **Leaks:** If any part of the administration set is wet, there could be a leak which may pose an infection risk.
- **Air:** The presence of air bubbles in the line can present extreme danger to the patient.
- **Kinks** in the administration lines, for example, due to the patient's position, may cause an occlusion.
- **Discolouration** or precipitation
- **Loose connections:** 'finger tightness required'.

The Pump

- **Power:** Ensure that it is plugged in and not running from the battery whenever the patient is not mobile.
- **Settings:** These should be as prescribed.

- **Operation:** Ensure that the pump is still working and check for leaks through the lines. Check 'volume infused' display, and check 'pressure display' for early notice of an occlusion.

10. Practical Aspects and Complications of Injectable Therapy.

10.1 Flushing Intravascular Lines

All solutions used for intravascular flushes are Prescription Only Medicines, and must always be prescribed and a record of the administration should be made.

A patient group direction has been produced to allow designated staff groups to administer sodium chloride 0.9% as a flush under defined circumstances. This PGD is available on the Trust intranet [PGD Saline Flush](#).

Where the requirements of the PGD are not fulfilled then flushes should be individually prescribed.

Ampoules of the recommended solution should be used to prepare a flush: an infusion bag is a 'single use only' product, and should only be used for continuous flushing. It must not be used as a multi-dose container under any circumstances.

The Trust requires the use of Sodium Chloride 0.9% wherever possible and clinically appropriate. In line with the requirements of the NPSA Rapid Response (April 2008), [NPSA RRR April 2008 Heparin Flushes](#) the use of heparin flushes in peripheral lines is not recommended.

Organisational guidelines ([Adult and Paediatric guidelines for the care of Central Venous and Midline Catheters](#)) are available to support the standardisation of flushing in patients with central venous and midline catheters.

10.2 Use of administration lines/giving sets

Always inspect the administration set, and any other components of the infusion system for damage before priming the line. Obtain a new giving set or infusion device if there is any doubt about the status of the line.

Where an infusion device is used, staff must always use an administration set which meets the specification recommended by the manufacturer of the infusion device. For syringe pumps, always ensure that the pump is set up for the manufacturer and size of the syringe.

10.2.1 Preventing Free-Flow

"Free flow" describes what can happen if an infusion line that is thought to be controlled by an infusion device is accidentally left in an open setting, allowing fluid to pass into the patient in an uncontrolled manner.

10.2.1.1 Free-Flow Associated with the use of Volumetric Infusion Pumps

- If you are using a volumetric infusion pump, free-flow will not occur if the giving set is loaded correctly into the equipment, and the door or other sealing device e.g. roller clamp is placed in the closed position.
- Users should always ensure that the roller clamp, or equivalent device, is closed before removing the administration set from the pump. This should always be the main means of closing the line, even if the administration set is fitted with an anti free-flow device.
- Anti free-flow devices are fail safe mechanisms, included in the construction of many of the more modern giving sets, which prevent the accidental free flow of solution if the giving set is removed from its infusion pump, or the door or other sealing device is left open or not securely closed. The Trust encourages the use of these devices in all clinical areas, particularly when used for higher risk patients or drugs.
- Regardless of whether such a device is fitted, staff should always be vigilant and ensure they manually clamp off any line that is not in use, or is to be removed from an infusion device.

10.2.1.2 Free-Flow Associated with the use of Syringe drivers

- Free-flow will not occur with syringe pumps if the syringe is loaded correctly, the plunger and barrel are correctly secured, and there are no loose or broken connections between the extension line and the syringe or catheter site.
- The risk of free-flow is minimised by using micro or narrow bore intravenous extension lines, and avoiding wide bore extension lines.
- Practitioners should minimise the risk of free-flow by positioning syringe drivers at a similar height to the infusion site, and NEVER more than 80 centimetres above.

10.3 Extravasation

10.3.1 General

Extravasation is the inadvertent infiltration of intravenous medication / fluid from a blood vessel into the interstitial tissue. It can occur for a number of reasons and morbidity ranges from temporary local pain or inflammation to extensive tissue necrosis with loss of motor and sensory function in the affected extremity. The severity of tissue injury is dependent on the drug, dose, concentration, physiochemical characteristics, site of extravasation and duration of soft tissue exposure.

“The process of tissue destruction caused by the leakage of a vesicant (any drug which has the potential to cause tissue damage) into tissue is by nature indolent and progressive. The first sign of extravasation is usually pain and burning at the site of infiltration. This may be followed quickly over the next few hours by redness, swelling and superficial skin loss. The induration may increase and necrosis may begin to develop one to four weeks later. There may be a loss of spontaneous healing and over the course of weeks to months; ulcers may become wider and deeper, sometimes involving underlying structures such as tendons and nerves.”

As the signs of extravasations can occur during or after administration this should be considered when an area of inflammation is identified in a patient who has had a venous access device in situ.

10.3.1.1 Groups of patients at increased risk of extravasation

Infants and neonates

Neonates possess a smaller amount of subcutaneous tissue in comparison to an adult, and have a less robust vascular system. Extravasated material can therefore become more concentrated in the tissues.

Patients unable to vocalise/communicate their pain

Comatose, anaesthetised patients, infants and those being resuscitated are not able to provide clear vocalisation of any pain / discomfort which may provide the first indication of a potential extravasation. Patients who experience problems / difficulty with communication may also experience difficulties in vocalising pain / discomfort e.g. individuals in whom English is not their first language, patients with learning difficulties, dementia etc.

Patients with

Vascular impairment e.g. peripheral vascular disease, Reynaud's disease, the elderly and those who have had radiotherapy at the venous access site

Impaired ability to sense pain e.g. diabetics, peripheral neuropathy

Poor venous drainage e.g. lymph node removal, superior vena cava syndrome, stroke.

Multiple attempts at venepuncture.

10.3.1.2 Drug factors affecting extravasation

Cytotoxic drugs

Cytotoxic extravasation is reported to occur at a frequency of 0.1 to 6.5% of all cytotoxic infusions and a number of cytotoxic agents can cause extensive tissue damage.

Vasoconstrictor drugs

Due to their direct vasoconstrictive action on blood vessels, drugs such as adrenaline, noradrenaline, dobutamine, dopamine and vasopressin reduce the ability of blood vessels in the extravasated area to allow blood to flow freely.

Irritant drugs

Extravasation of irritant drugs may lead to tissue damage and necrosis. The following factors need to be considered before giving an intravenous drug:

- **pH of drug**

Solutions with a high or low pH will cause more tissue damage if they are extravasated.

- **Osmolarity of drug**

Solutions with an osmolarity greater than that of plasma (>290 mOsmol/l) may cause tissue damage. The majority of intravenous drugs are formulated to have a similar osmotic pressure as plasma. The table below lists a selection of the drugs that have higher osmolarity and which may therefore potentially cause a problem if extravasated.

Intravenous Injection	Osmolarity (mOsmol/L)
Glucose 10%	535
Glucose 20%	1,110
Glucose 50%	2,775
Calcium Chloride 5mmol/10ml	1,500
Co-trimoxazole 480mg/5ml	541

Intravenous Injection	Similarity (mOsmol/L)
Mannitol 10%	550
Mannitol 20%	1,100
Magnesium Sulphate 50%	4,060
Potassium Chloride 20mmol/10ml	4,000
Sodium bicarbonate 4.2%	1,004
Sodium bicarbonate 8.4%	2,008

10.3.1.3 Administration factors affecting extravasation

- **Education / Training**

Intravenous drugs must only be administered by practitioners who have received additional training and who are deemed competent in ANTT and IV Administration (See 2.1 and 2.2) N.B. A number of additional standards support the safe administration of cytotoxic chemotherapy.

- **Site of administration**

The selection of the site is a very important factor when administering an intravenous drug. Areas which have small amounts of subcutaneous tissue are the most likely to be problematic should a drug extravasate. The antecubital fossa is one of the sites most often implicated in extravasation injury and should be avoided when administering irritant, vasoconstrictive or cytotoxic drugs. Care should also be taken when administering these categories of drugs in the dorsum of the hand and foot.

- **Method of venepuncture / Cannulation**

The repeated use of any single vein for venepuncture increases the risk of the drug extravasating into the surrounding tissues.

Intravenous peripheral cannulation support the insertion of the shortest cannula with the smallest bore i.e. 22 or 24 gauge. A non-ported plastic cannula should be used. The use of stainless steel needles should be avoided as this will increase the risk of infiltration.

- **Administration**

- **Medical devices**

Although medical devices with variable pressure alarm and pressure monitoring facilities can be used, vigilance should be maintained when administering infusion therapy via electronic infusion devices. Regular visual checks should be carried out in accordance with infusion monitoring guidelines.

10.4 Management of Extravasation

Extravasation should be suspected if one or more of the following are present:

- Patient complains of burning, stinging or any discomfort at the vascular access device's injection site.
- Inability to aspirate blood from the vascular access device
- Resistance is felt when the drug is given as a bolus.
- There is an obstruction to flow of fluid when an infusion is in progress.
- Swelling or leakage is observed at the injection site.

The general procedure to follow is set out below. On occasions a variation to this procedure may be appropriate (e.g. administration of Hyaluronidase). This should occur under medical advice and be judged on a case by case basis. Specific information pertaining to the extravasation of cytotoxic drugs can be found in the systemic anti-cancer medicines guidelines.

Immediate action – cannula

- Stop the administration of the drug.
- Attempt to aspirate any residual drug through the cannula.
- Where appropriate administer a prescribed antidote of 0.4 - 1mls through the cannula into the extravasation bed (volume depending on patient comfort and local factors e.g. pressure).
- Remove the cannula.
- In most instances, apply a cold gel pack for 15 – 20 mins (every 20 – 40 minutes for the first few hours), three to four times a day for up to 3 days to induce vasoconstriction to reduce the risk of local destruction and reduce the local uptake of the drug/ local oedema and to slow the metabolic rates of the cells.
- In some instances (recommended for the management of non-DNA binding cytotoxic drugs) warm gel packs should be applied for 15 – 20 minutes (every 20 – 40 minutes for the first few hours), three to four times a day for 24 – 48 hours to increase blood supply / dispersion and absorption of the neutralising agent.
- Mark borders with indelible ink.
- Elevate the limb.
- Inform the medical staff immediately.
- For all serious cases, and if there is any doubt about the long term consequences, consider medical photography and refer to the plastic surgery team for assessment and advice on treatment at the earliest opportunity.

Subsequent Action

Careful recording of the following in the medical and nursing notes are recommended:

- Date and time of the incident
- Name and signature of nurse/doctor administering the drug/noticing the incident
- Drugs, diluents, and/or fluids involved
- Drug administration technique
- Needle size, type and the site of cannulation
- Appearance of site
- Approximate amount of drug and fluid extravasated
- The patient's symptoms and statements
- Time and names of the doctor(s) notified
- Follow up procedure – including completing an incident form IR1

- Time and date of referral to plastic surgery team (if appropriate)
The doctor/nurse administering the drug should complete an incident form and any other relevant documentation.

10.5 Use of Infusion devices / giving sets.

Please see the [Medical Device Policy](#).

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