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 an electronic training package, and be signed off as competent by their assessor prior to performing any related activities (see section 1.1)

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, Midwives and Operation Department Practitioners (ODP)

Provided they are registered nurses/midwives or ODPs who have successfully completed their intravenous drug administration assessment (see training below), they (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.

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.

It is recognised that certain circumstances require deviation from the policies. In such cases the Injectable Medicine Policy allows for the use of approved local operational policies e.g. single nurse intravenous administration by community nursing.

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. See the Parenteral Therapy Protocol: Management and Administration of Injectable Medicines by a Lone Community Registered Practitioner for further information.

Nursing Associates
Nursing Associates who are deemed competent are permitted to administer subcutaneous and intramuscular injections. They are also permitted to act as second checkers for intravenous drugs prepared and administered by a qualified nurse.

Radiographers
Radiographers who are competent to administer intravenous medicines may administer intravenously as defined by departmental protocol, or otherwise prescribed by a radiologist, medicines required for contrast enhanced radiological procedures, 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) can administer intravenous medicines to patients undergoing cardiac by-pass under an appropriate prescriber’s direction i.e. an anaesthetist or cardiac surgeon. All trainee clinical perfusionists must be supervised by an accredited and registered clinical perfusionist when performing this role.

A clinical perfusionist can administer intravenous medicines without supervision following a satisfactory assessment by an accredited and registered perfusionist.
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.
Intravenous preparation and administration is considered 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 to the nurse in charge before they can administer intravenous medications in the clinical area.

Staff working on the Staff Bank are required to provide evidence of this training to the Staff Bank Manager such that a log of staff competent to prepare and administer injectable medicines can be maintained. This evidence should ensure that their knowledge and skills are up to date, they are familiar with relevant Trust policy, and their administration techniques comply with Trust policy and the Training Competency for intravenous drugs administration.

When making a booking from the Staff Bank, Trust staff must state if this skill is required such that bank staff may be allocated appropriately.

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 manager or professional lead.

Foundation programme doctors have a requirement to complete Core Procedure ‘Prepare & administer IV medications, injections and fluids’.

Role specific training for medical staff is provided at directorate level where the need is identified.

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). See section 1.2 regarding competence.

1.1.1 Clinical Skills Training
This non medical training incorporating injectable medicines is 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
The electronic training package (see section 1.1.2) can be accessed by any member of staff. It is also a valuable tool for staff wishing to refresh their skills. This package does not however replace the need for formal training and assessment for practitioners who do not routinely administer medicines via the peripheral intravenous route (see the Peripheral Intravenous Drug Administration Competency Training Pack for details).

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 e-learning. 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.

**1.2 Competence**

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 exception 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, must be signed off as competent for preparation, administration and monitoring of injectable medicines by a senior practitioner in their clinical area. This sign off should take the form of a suitably completed Trust Peripheral Training Competency for intravenous drugs administration.

A record of competent staff should be kept in the individual’s portfolio and recorded on ESR.

**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. See the Patient Self Administration of Drugs Policy for further detail.

**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 poor non touch technique 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
Examples of where the injectable route may be favoured are as follows (note this is not a comprehensive list):
• 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
• 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.
• 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 (see section 10).
• Infection by microbial contaminants if strict Aseptic Non Touch Techniques are not adopted, 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**
Practitioners should refer to product literature, and the information in this document, and use the recommended injection time.

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. If no specific information is available regarding the injection time, 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 considered as open systems as they have an air inlet on the burette chamber and so have increased potential for microbial contamination.
A 5 micron filter is present within the air inlet, however this pore size will not inhibit the ingress of microorganisms.

- A separate burette should be used for each injectable medicine. Where this is not possible a risk assessment should be documented. Using the burette for more than one drug increases the chance of incompatibilities and sequential drug additions will result in a change in the contents of the burette with time and will create labelling problems.

- Thorough mixing within the burette chamber is difficult. Sequential additions of injectable medicines should be avoided.

### 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.

**Note:** the standards below are also applicable to Patient Controlled Analgesia.

- The Saving Lives (High Impact Interventions (Care Bundles)) project in this Trust requires intravenous administration **lines** (used to administer clear fluids or infusions containing medication) to be changed at least every **72hours**.

- Continuous intravenous infusions of medicines e.g. infusion bags or syringes are to be changed at least every **24hrs**. The start date and time should be clearly indicated on the labels provided. In exceptional circumstances where an infusion from a single container is intended to continue for more than 24 hours, a formal risk assessment must be undertaken (and accepted by the Medicines Management Committee) to determine the safest course of action.

- Any disconnection required should be brief and aseptic and the line should be changed if this cannot be guaranteed. Where blood products are involved see **Blood Transfusion Policy**.

### 3.3.1 Patient Controlled Analgesia (PCA)

A PCA infusion provides rapid pain relief when a quick response or high serum concentration is required. PCA administration is usually via a peripheral or central venous catheter, but in exceptional circumstances can be administered subcutaneously.

PCA infusions are commonly used in the post-operative period. They allow patients to self-administer a bolus of analgesia, within specific limits defined by the prescriber.
All PCA infusions should be initiated in theatre by an anesthetist however a trained practitioner can renew the syringe. Infusion rates must only be altered by an anesthetist or a practitioner from the Acute Pain Service. There may be exceptional circumstances where a PCA is initiated in a non-theatre area, local procedures should be adhered to in this circumstance.

All PCA infusions must be prescribed on a designated Trust prescription chart and a designated PCA pump must be used for administration.

Further information can be found in the Protocol for Routine use of Patient Controlled Analgesia in Adults (NUTH) and the Protocol for Routine use of Patient Controlled Analgesia in Paediatrics (NUTH).

4 General Information - Intramuscular Route

- Intramuscular injection is a less efficient method of parenteral administration than the intravenous route because;
  - It has a slower onset of action (as the proportion of drug that enters the circulation quickly is less that with intravenous drugs).
  - 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 is easily accessible, particularly in situations where IV administration is not practical due to lack of access or in an uncooperative patient.
- Intramuscular 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.
- Intramuscular injection maybe the only option for drugs, that cannot be formulated for intravenous administration.

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. Skin cleansing should occur as directed by Trust guideline.

Additional information including diagrams relating to the recommended sites for administration can be found in Chapter 12 of the Royal Marsden Manual.

Adults

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.
Sites for administration:
• 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. Up to 2.5 mL can be safely injected into the ventrogluteal site.
• 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)**
Sites for Administration:
• Vastus Lateralis - Recommended for children less than 5 years old
• Rectus Femorus – 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.
• Deltoit 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.

Rotation of administration sites can decrease the likelihood of localised tissue irritation and ensure improved absorption. It is good practice to document the site of administration on the patients administration chart to facilitate this. It is
recommended that different sites are used if the patient is receiving multiple concurrent therapies via the subcutaneous route

**Subcutaneous Injections**

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.

The minimum possible volume, no greater than 2ml, should be administered via subcutaneous injection to prevent irritation.

**Subcutaneous Infusions of Simple (Inactive) Fluids**

A subcutaneous infusion of simple fluids must only be used for hydration. Subcutaneous infusion is a safe, reliable and easily administered method of maintaining adequate hydration for patients with poor intravenous access that are unable to take adequate oral fluids. It is not a substitute for intravenous fluids and all other routes, including nasogastric, should be considered first.

Note: Patients with oedema or malnutrition may be unable to absorb fluids given by the subcutaneous route.

- Suitable sites for infusion, with adequate subcutaneous tissue, include anterior abdominal wall, behind shoulders, middle third of thigh or upper chest. Patient convenience should also be considered.

- The administration site must be rotated each time the administration line is changed (administration lines used to administer clear fluids must be changed at least every 72 hours) or after a maximum of 2 litres has been infused (whichever is associated with the shortest duration).

- The continued clinical need for simple subcutaneous fluids for hydration must be assessed at least every 24 hours.

- Monitoring must be undertaken as outlined in Section 9. Bruising, the presence of large flat white marks or leaking from the administration site can occur following administration of a subcutaneous infusion. This may require additional monitoring or removal of the cannula as clinically indicated.

See Section 8.8 for further information.

**6 Other routes of Injectable Administration**

**6.1 Intrathecal Administration – General Information**

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 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).

6.2 Epidural and Intrathecal Infusions

The following information is to be used in conjunction with Trust epidural or intrathecal policies and procedures.

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. Intrathecal infusions are given into the intrathecal space and are most frequently prescribed in palliative care patients with severe pain.

The positioning of the epidural or intrathecal catheter will determine the extent of the nerve block.

Intra-operatively, an epidural infusion will be initiated in theatre by the anaesthetist or a designated anaesthetic assistant on instruction from the anaesthetist. All intrathecal infusions can only be initiated by an anaesthetist.

A Trust approved epidural or intrathecal prescription chart, as appropriate, must be completed by an appropriately qualified prescribing practitioner (usually an anaesthetist) for all infusions.

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

A designated epidural or intrathecal pump must be used for all epidural or intrathecal infusions as appropriate. The pump must be clearly marked with the words “For epidural use only” or “For intrathecal use only” as relevant to the route.

A designated administration set and line must be used with yellow colouring to distinguish them from other administration lines.

Epidural lines must be labelled with an “epidural” sticker and infusion bags must be clearly labelled “For epidural use only”.

(The NPSA has issued a Patient Safety Alert (Part b) which requires that 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 (epidural only) responsible for epidurals in the delivery suite, must perform changing of the infusion bag or infusion rate on the epidural / intrathecal pump. All changes to an epidural or intrathecal infusion must be recorded on the designated epidural / intrathecal chart as appropriate to the route.

Problems with the epidural / intrathecal 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 or intrathecal 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 every 3 years and complete the necessary competencies as set out by the pain team.

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, but are not limited to:

- 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 All Injectable Medicines

7.1 General Procedure for Aseptic Non Touch Technique to be used in Clinical Areas.

Points to Note Prior to Preparing an Injectable Medicine:

- 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. See Injectable Medicines Policy (Section 4.2.4).
- Ensure you are familiar with the manufacturer's product information or local guidelines to prepare the medicine.
• Beware of the risk of confusion between similar looking medicine packs, names & strengths: read all labels carefully.
• Ensure a second practitioner is available to perform an independent second check (where appropriate).

Procedure:

Aseptic Non Touch Technique must be applied at all times when preparing an injectable medicine

• 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. clean utility in most clinical areas).
• Assemble everything you need: Sharps bin for waste disposal, medicine ampoule(s)/vial(s), diluent, syringe(s) appropriate needles (e.g. 21g, 23g, 25g needle(s)), air inlet device(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.
  ➢ Medicine(s) were stored as recommended e.g. in the ‘fridge’.

Check that:
  ➢ The formulation, dose, diluents, 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.

Community nursing teams are an exception and are permitted to single check injectable preparation only when doing so in line with their approved local operational policy.

• Prepare the label for the prepared medicine (see Injectable Medicines Policy section 4.3.3)
Follow the Aseptic Non Touch Technique Guideline for Preparation (note this is for Intravenous therapies but the principles can be applied to injectable medicines for other routes). The key steps are defined below:

- Wash hands according to Trust Hand Hygiene policy. Adhere to “bare below the elbows” in accordance with the Trust Dress, Appearance and Uniform Policy.

- Use an alcohol wipe to disinfect the surface of the reusable plastic trays. Areas designated by Infection Prevention and Control to use disposable trays must also perform this important step.

- Assemble the syringe(s) and needle(s): peel open wrappers carefully and arrange all ampoules/vials, syringes and needles neatly in the tray.

- Put on an apron

- Put on a pair of disposable protective gloves.

- 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.

Note: Under no circumstances should a medical device such as a flush of sodium chloride be used to reconstitute medicines.

- Once the prepared medicine is appropriately checked and labelled 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 Injectable Medicines Policy Standard 4.2.2).

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.

Community nursing teams are an exception and are permitted to single check an injectable preparation only when doing so in line with their approved local operational policy.
7.2 Withdrawing solution from an ampoule (glass or plastic) into a syringe

- Tap the ampoule gently to dislodge any medicine in the neck.
- Cover the neck of the ampoule with a sterile topical swab and snap it open. If there is any difficulty, a ampoule opening aid may be required.
- Attach a needle / filter straw/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.

*Filter straws/needles prevent the unintended injection of glass shards which may be present after opening a glass ampoule.

A filter straw / needle is not necessary where injections are being drawn up for oral use e.g. Konakion MM.
- 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, section 4.3.3
- If the ampoule contains a suspension rather than solution, it should be gently swirled / rolled 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.
- If the vial contains a suspension rather than solution, it should be gently swirled / rolled to mix the contents, immediately before they are drawn into the syringe.
- Remove the Air Inlet Set cover and insert the Air Inlet Set into the vial through the rubber septum. The tip of the vent needle must always be kept above the solution to prevent leakage.
- Attach a needle to a syringe, remove the needle cover and insert the needle into the vial through the rubber septum.
- Invert the vial. Keep the needle in the solution.
• Release the plunger so that solution flows back into the syringe.

• 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.

• Fill the syringe with the required volume of solution. Withdraw the needle from the vial.

• Remove the needle and exchange it for a new needle or a sterile blind hub. Care must be taken when changing the needle to ensure the total volume remains within the syringe and is not removed with the needle. This is only likely to have a significant impact where very small volumes are used e.g. in neonates.

• Label the syringe according to the Injectable Medicines Policy, section 4.3.3

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.

• Remove the Air Inlet Set cover and insert the Air Inlet Set into the vial through the rubber septum. The tip of the vent needle must always be kept above the solution to prevent leakage.

• Inject the diluent into the vial.

• With the syringe and needle still in place, gently swirl / roll 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.

• 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. 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 intact.

• 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 syringe according to the Injectable Medicines Policy, section 4.3.3

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.

• 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.

Community nursing teams are an exception and are permitted to single check an injectable preparation only when doing so in line with their approved local operational policy.

- Fit a blind hub to the administration syringe and invert several times to mix the contents.

- Carefully check the syringe for cracks and leaks and then label it (see Policy section 4.3.3, noting especially the requirements specific to syringe drivers).

- Remove the blind hub. Tap the syringe lightly to aggregate the air bubbles at the needle end. Expel the air and fit a new blind hub.

- 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

- See [Injectable Medicine Policy](#) Standard 4.3.3.
- Only a labelled syringe must be fitted to a syringe driver or similar device.

Place the final syringe or infusion in a clean plastic/ smooth 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 and a plastic apron 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 maximum daily dose has not been exceeded (where applicable)
- 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 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 for all injectable routes excluding Intramuscular and Subcutaneous (in most circumstances). The Medicines Policy advises that that a second check of an injectable medicine via the intramuscular or subcutaneous route is only necessary in specific circumstances (see the Medicines Policy for further detail).

However,
- Insulin administered by any injectable route requires an independent check by a registered practitioner.

- Practitioners administering an injectable medicine via the intramuscular or subcutaneous route should always work within their competence and ask for an independent check if in any doubt.

*In the community setting single nurse administration of insulin may be undertaken based on a local risk assessment.

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.

Community nursing teams are an exception and are permitted to single check an injectable preparation only when doing so in line with their approved local operational policy.

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 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

Aseptic Non Touch Technique **must** be applied at all times when administering an injectable medicine

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

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

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

8.2.4 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.
• Re-usable trays must be decontaminated with a universal sanitising wipe and dried thoroughly after each use. Disposable trays must not be reused.
• All re-usable trays must be washed with hot water and detergent, rinsed and left to dry, on a weekly basis.

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

Following the performance of the independent second check, described in 8.1.1 and 8.2.2, 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 chart three times a day in accordance with the Trust Insertion and Management of Peripheral Intravenous Cannulae Policy.
• The injection port 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.

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 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.

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 as per the Trust Waste Management Policy.

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 fluids must be discarded after they have been disconnected from the giving set; reuse of a part used infusion solution must never be permitted.

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 administration set for each, connected using a Y-connector (preferred), or a 3-way tap (greater risk of infection) where appropriate to the specialist area. 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 line 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 and Infusions

- 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 needle.
- 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 must be less than 2 ml 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

- A sterile transparent occlusive adhesive dressing should be used to secure the cannula / butterfly device 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.

Subcutaneous Infusions of Simple (Inactive) Fluids (for hydration)
- Only isotonic solutions can be administered via the subcutaneous route. Approved fluids are:
  - Sodium chloride 0.9% (use first line)
  - Sodium chloride 0.18% and glucose 4% (dextrose saline)
  - Sodium chloride 0.45% and glucose 2.5%

- The recommended rate of infusion is between 30ml / hour and 80 ml / hour (maximum rate of 1ml/kg/hour for adult patients as above)
- The maximum volume of simple (inactive) fluid to be administered, via subcutaneous infusion, within 24 hours is 2 litres.

- The needle should be inserted a 45 degree angle into a suitable site (see section 5 above). Details relating to the insertion of the cannula must be documented in the nursing record, this should include site, date and time of insertion. The date and time of insertion must also be recorded on the occlusive dressing which is used to secure the cannula (see above).

- A Trust approved cannula attached to a standard administration line must always be used. A list of approved cannulas and their order details are available on the Interim Safety Devices Inventory.

- Subcutaneous infusions of simple fluids must be by administered by gravity only (an infusion device must NEVER be used for the administration of simple (inactive) fluids by subcutaneous infusion).

  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 usually recommended as this prevents effective monitoring of the injection site. (Transparent tape is permitted.) Where bandaging is unavoidable, it should be removed to observe the injection site and then replaced with new bandaging.
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. Directorates should decide and document whether the minimum standard is suitable for their clinical areas. It is anticipated that some clinical areas will need to exceed this minimum requirement.

- **Active infusions** should be monitored as described below at least hourly. The frequency of monitoring can be amended following a documented approval from a prescriber.
  - A documented record must be made that the active infusion monitoring has occurred. Directorates should consider the use of the Active Infusion Check Chart for this purpose.
- **Inactive (simple infusion fluids) infusions** should be monitored at least 4 hourly. Monitoring may be required more frequently if clinically indicated.
  - A documented record must be made that the inactive infusion monitoring has occurred. Directorates should consider the use of the Fluid Balance Chart for this purpose.

Clinical areas or Specialties documenting the monitoring of infusions by a pre-existing Trust approved chart, e.g. PCA and epidural infusions given by The Acute Pain Service, are an exception from the requirement to use the Active Infusion Check Chart.

Community nursing teams are an exception and must follow their approved local operational policy.

**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.

*Subcutaneous Infusions of Simple (Inactive) Fluids only:*

- **Oedema**: The site of administration should be monitored for residual subcutaneous oedema. Gentle massage of the administration site should
resolve any local oedema. Consideration should also be given to reducing the rate of infusion and/or changing the site of administration.

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.

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. The Trust requires the use of Sodium Chloride 0.9% wherever possible and clinically appropriate.

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.

Where identification of multiple invasive lines is necessary the Guideline for Labelling Invasive Lines should be referred to.

#### 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, the clamp is secure 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**
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.

<table>
<thead>
<tr>
<th>Intravenous Injection</th>
<th>Osmolarity (mOsmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose 10%</td>
<td>535</td>
</tr>
<tr>
<td>Glucose 20%</td>
<td>1,110</td>
</tr>
<tr>
<td>Glucose 50%</td>
<td>2,775</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intravenous Injection</th>
<th>Similarity (mOsmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mannitol 10%</td>
<td>550</td>
</tr>
<tr>
<td>Mannitol 20%</td>
<td>1,100</td>
</tr>
<tr>
<td>Magnesium Sulphate 50%</td>
<td>4,060</td>
</tr>
<tr>
<td>Intravenous Injection</td>
<td>Osmolarity (mOsmol/L)</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Calcium Chloride 5mmol/10ml</td>
<td>1,500</td>
</tr>
<tr>
<td>Co-trimoxazole 480mg/5ml</td>
<td>541</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intravenous Injection</th>
<th>Similarity (mOsmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium Chloride 20mmol/10ml</td>
<td>4,000</td>
</tr>
<tr>
<td>Sodium bicarbonate 4.2%</td>
<td>1,004</td>
</tr>
<tr>
<td>Sodium bicarbonate 8.4%</td>
<td>2,008</td>
</tr>
</tbody>
</table>

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 (See 1.1 and 1.2) 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.

- **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 via the Datix reporting system.
- 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.

11 References
- Medicines for Children. 2nd ed. RCPCH, NPPG; 2003. ISBN 190095468 0
- NPSA. Patient Safety Alert 20. A multidisciplinary practice standard listing core principles of safe practice
- NPSA. Infusion Device Training www.clpu.nhs.uk
- The Joint Council for Clinical Oncology (1994) Quality Control in Cancer Chemotherapy. Managerial and Procedural Aspects