1.0 INTRODUCTION

Neonates admitted to the neonatal intensive care unit (NICU) are either born prematurely or at term but are sick and have a variety of clinical problems. A range of medicines including parenteral nutrition, blood and blood products may be prescribed. Medicines are administered to neonates via different routes and by different methods to ensure that specific therapeutic outcomes are achieved.

Many professionals are involved in the medication process. Therefore the safe and effective administration of medication is the topmost priority of all professionals involved to prevent and minimise medication errors. Medication related incidents across the nation are consistently reported amongst the top three types of patient safety incidents by NLRS 2009 – 2015 with incidents ranging from 11-14% of the total. Approximately 13,000 neonatal related incidents were reported to the National Patient Safety Agency (NPSA) between April 2006 and March 2007, and medication errors accounted for more than 18% of incidents involving the newborn. This evidence shows that medication errors can occur in all stages of the medication process. In NUH neonatal unit data over the past 6 years drug related incidents accounted for 33-43% of the total reported errors with a peak in 2013 and steady decline thereafter at its lowest in 2015. Although blood is not classified as a medicinal product some blood components are, and therefore, blood is included in this guideline.

1.1 Policy

This policy applies to all babies admitted to the neonatal intensive care unit, and also applies to babies in transitional care or maternity wards who require administration of intravenous antibiotics.
To improve medication safety all healthcare professionals involved in medicines management should complete a programme of learning and develop work based competencies (NPSA, 2007; Royal College of Nursing, 2008; National Service Framework, 2004; Audit Commission, 2001). All staff working with medicines management in the Nottingham University Hospitals (NUH) must be familiar with and follow the policy and procedures contained in the current Medicines Code of Practice (Nottingham University Hospitals NHS Trust).

Registered nurses or midwives will have successfully completed the Intravenous Administration of Medication (neonatal version): an educational self-directed package for nurses and midwives; will have completed a period of supervised clinical practice and developed a reflective practice log; and achieved the specific competencies for the intravenous administration of medicines to neonates. Practitioners are required to review and update their knowledge and practice yearly to ensure safe, effective and competent practice.

Intravenous fluids and medicines administered to neonates must be checked by two practitioners who are competent in medicines management and who work within the scope of their professional practice.

Doctors who prescribe will have completed a neonatal specific prescribing induction for medicines and parenteral nutrition; have an educational self-directed package and completed a competency package for medical staff.

1. 2 Links
- Neonatal clinical guideline D6: Total parenteral nutrition
- Neonatal clinical guideline D13: Administration of non-intravenous drugs to neonates
- Neonatal clinical guideline A8: Early Care Guideline: Resuscitation and early care of the preterm infant < 28 weeks gestation
- Neonatal clinical guideline E1: Red cell transfusion in the newborn
- Neonatal clinical guideline G3: Management of a baby with a central venous catheter
- Neonatal clinical guideline G5: Management of umbilical venous catheters
- Transfusion Policy, Nottingham University Hospitals, NHS Trust
- Right patient, Right blood; National Patient Safety Agency (www.npsa.nhs.uk)

2. 0 BACKGROUND

Neonates are prescribed a range of medicines depending on their clinical need, which are administered via different routes to meet specific therapeutic outcomes.

The reasons for intravenous administration are: -
- To achieve predictable therapeutic levels
- When the drug is not absorbed from the gastrointestinal tract
- When drugs and fluids cannot be administered via the oral route
- When the baby’s gastrointestinal tract requires to be rested
- When the drug would be inactivated by the gastrointestinal tract

2.1 Methods of intravenous administration
- Bolus
  Direct administration of a medication via a designated administration port
  This method is preferred when optimum serum levels are rapidly required or when the medicine is unstable in solution.
- Continuous infusion
  The medication is added to a large volume of fluid for slow continuous infusion
  Continuous infusions are used where the drug would be quickly metabolised and excreted and to obtain prolonged constant plasma levels of a drug.
Intermittent infusion
The medication is added to a small volume of fluid for slow infusion over a limited period of time.
Intermittent infusions are used to avoid venous irritation or toxicity.

2.2 Routes of intravenous administration
- Peripheral venous cannula (PVC)
- Central catheters: Peripheral long line (Silastic)
- Broviac catheter
- Umbilical venous catheter (UVC)

2.2.1 Central Lines
Bolus or intermittent infusions must not routinely be administered through a peripheral long line or a broviac catheter. This is because central lines are often used for PN or for continuous medicine infusions that should not be flushed. Frequent access and line manipulation increase the risk of bacterial contamination. Bolus or intermittent infusions may be administered via these routes in exceptional circumstances after discussion with a registrar. The consultant should be informed at the next ward round.

Umbilical venous catheters are central lines and are usually used during newborn resuscitation or in the neonatal setting. Resuscitation drugs are administered via this route and further guidance is outlined in the Early Care clinical guideline (Nottingham Neonatal Service, A8). Other indications for use include: when peripheral venous access is difficult or not available; exchange transfusion; in the very premature baby (<26 weeks gestation) when minimal handling is essential; inotrope infusion in a baby ≥ 26 weeks gestation and minimal handling is essential; where multiple medication infusions are likely; and to measure central venous pressure (NNS G5, 2015)

3.0 ROLES AND RESPONSIBILITIES

3.1 Professional Conduct
All practitioners who administer medicines are responsible and accountable for their practice in accordance with the standards laid down by their professional registration body. The Nursing and Midwifery Council (NMC) provide additional guidance in their document Standards for Medicines Management (2010)). Further guidance for all health professionals is provided in the current Medicines Code of Practice: Administration of Medicines (NUH).

3.2 Staff authorised to administer intravenous medicines
Nurses, midwives and doctors are authorised to prepare and administer prescribed intravenous medicines in the neonatal intensive care unit as described in section 1.0 policy. When a student midwife is also a registered nurse they should not administer intravenous medicines to neonates.

3.3 Staff authorised to be a first checker
Practitioners who are authorised to be a first (1st) checker and administer intravenous medicines are also authorised to be a second (2nd) checker. When a student midwife is also a registered nurse they should not be a 1st or 2nd checker for the administration of intravenous medicines to neonates.

3.4 Staff authorised to be a second checker only
Practitioners who are authorised to be a second (2nd) checker of prescribed intravenous medicines will have successfully completed parts 1 and 2 of the Drug Calculation learning package during their neonatal nursing foundation programme.
3. 5 Learners
Student nurses, midwives, medical students and clinical observers are not permitted to administer intravenous medicines or be a 2nd checker (NUH, 2011). During their placement all students have medicines management learning opportunities. They can check and administer oral and topical drugs supervised by a designated registered nurse/midwife (not a clinical support worker) and this allows them to develop their knowledge, skills, attitudes and competence when administering medicines to neonates. They must have passed their maths exam and OSCE. If a student has not passed this then we should consider alternatives, such as the drug calculation learning package and practical assessments prior to a ‘real time’ administration of an oral/topical drug. The practitioner is accountable and must be present throughout the medicine administration process and complete all documentation.

3. 6 Preparation of medicines for administration by doctors
When a medicine is prepared by a nurse and administered by a doctor the following action should be taken:
- The medicine must be prepared in the presence of the doctor
- When this is not possible for example, during resuscitation, the nurse must retain the ampoule/vial from which the medicine was taken and this must be shown to the doctor before administration
- The doctor and nurse must follow the procedure for checking and the administration of medicines as described in Section 5.0 of this guideline.

3. 7 Handover of care: infusions of drugs and fluids
During the handover of nursing care from one practitioner to another, at the beginning of the morning and evening shift, it is critical that both practitioners check the following:
- The labels on syringes and bags used for infusion of drugs or fluids and include:
  - Drug additive
  - Amount
  - Vehicle
  - Total volume
  - Date and time added
  - Concentration
  - Added by and checked by

- What is prescribed on the neonatal intensive care unit daily infusion chart and includes:
  - Maintenance fluids/intermittent drug infusion prescription
    - Route, fluid/diluent, volume, additive, total amount of drug, rate/duration
  - Continuous drug infusion prescription and insulin sliding scale prescription
    - Route, drug, total amount of drug, diluent, total volume, equivalence, rate/range
  - Insulin sliding scale (in addition to the above)
    - Start the infusion at …. ml/hr for 1 hour followed by sliding scale
    - Blood sugar, insulin rate (ml/hr), insulin rate (units/kg/hr)

- The Fluid Balance Chart
  - The hourly volume and total

3. 7.1 Checking of information
The information recorded on the labels of syringes and on infusion bags must match the prescription on the daily infusion chart. If there is any discrepancy the infusion must be stopped and a new infusion commenced. The Sister in Charge and a senior doctor must be informed immediately, and a clinical incident report must be completed by both nurses.
3. 7.2 Rate/range and duration of infusion
The prescribed rate/range and duration of the infusion must also be checked against the recorded amounts in fluid balance section on the intensive care chart or high dependency chart, and if there is a discrepancy immediate action must be taken. Check with the prescriber if changes in the rate/range/duration/volume to be infused had been made but a new prescription not written. If no, then both nurses must together recheck prescription and adjust the prescribed rate on the infusion pump(s). The Sister in Charge and a senior doctor must be informed immediately, and a clinical incident report must be completed by both nurses.

4. 0 PRESCRIBING

Usually only medicines included in the NUH formulary and current British National Formulary for Children (cBNF) may be prescribed to babies receiving treatment in the NICU. However, there are some exemptions, which include medicines undergoing a clinical trial or specialist therapy approved by the Hospital Drugs and Therapeutics Committee for an individual baby.

4. 1 Authority to prescribe
Only legally authorised prescribers can prescribe medicines for hospital inpatients:
- Doctors
- Advanced neonatal nurse practitioners (ANNP) who have successfully completed a recognised programme for nurse prescribing. ANNPs can only prescribe medicines on the agreed list signed by the Non-medical Prescribing Committee.
- The clinical pharmacist has the authority to make minor or agreed amendments
- Nurses who are not prescribers must not transcribe or prepare a prescription for a prescriber to sign

4. 2 Prescriptions
- All prescriptions must be legible and written with indelible black ink only; or by approved stickers, pre-printed sections or be computer generated. A prescription that is ambiguous or unclear at any time must be re-written by the prescriber. The medicine should not be administered and should be discussed with the prescriber. Each prescription must be signed by the prescriber with their usual signature, and their name printed next to the signature with their bleep/contact number.
- Only one medicine must be prescribed per line on the inpatient prescription chart. Multiple charts should be either stored together or securely attached to each other. Each chart must be numbered in the space provided on the front of the prescription chart.
- The prescriber must re-write the prescription when an adjustment to the prescription is necessary for example, the dose or route of a medicine.
- A fixed medicine dose must be written on the ‘regular prescription’ section and medicine ranges are permitted only on the ‘as required’ section.
- Parenteral and enteral medicines must be administered at separate times, if the baby is prescribed both.
- Cancellation of treatment must be legible and the intention of the prescriber clearly understood. The remaining columns for recording administration must be crossed through with a bold diagonal line. The cancellation must be timed, dated and signed by an authorised prescriber.

4. 3 Verbal orders
Verbal orders must only be used in exceptional circumstances when a doctor or an advanced neonatal nurse practitioner cannot immediately be available in person to prescribe and where a delay may cause harm or prolong suffering to a patient. For further guidance refer to the current NUH medicines code of practice.

4. 4 Medicine name
Recommended International Non-propriety Names (rINNs) must be used for prescribing medicines. The rINN are used in the British National Formulary for Children (cBNF). The form the medicine is available in must be stated for example, cream, and liquid.
4. 5  **Medicine dose**

Generally, abbreviations should be avoided to prevent and minimise medication errors (NPSA, 2007; Adcock, 2001). Complex dose calculations may result in 10-fold or greater dose errors as a result of misplacement of the decimal point and confusion may occur when converting dose units for example, between micrograms and milligrams. Errors made when calculating doses may be compounded when calculating the volume of liquids needed for the dose (NPSA 2007; 2010).

The abbreviations that are approved for use on inpatient prescription charts are:

- G gram
- mg milligram
- ml millilitres
- mmol millimoles
- micrograms must be written in full and not abbreviated to mcg or μg
- nanograms must be written full and not abbreviated to ng
- The dose must be expressed in metric units and the dose clearly prescribed in the appropriate section.
- Decimal points that are unnecessary must not be used for example, 125 micrograms rather than 0.125mg. When a decimal point is required a zero must be written before the decimal point for example, 0.5ml not .5ml
- Chemical abbreviations should **not** be used for example, Na instead of Sodium. However, KCl and NaCl are allowed when used for intravenous fluids only

4. 6  **Route of administration**

The abbreviations that are approved for use for routes of administration are:

- IM Intramuscular
- IV Intravenous
- Inh Inhalation
- Neb Nebulisation
- NG Naso-gastric Tube
- NJ Naso-jejunal Tube
- PO By Mouth
- PR Per Rectum
- SC Subcutaneous
- SL Sublingual
- Top Topical

All other routes of administration must be written in full. Topical preparations that are to be applied to a specific site must have that site specified.

4. 7  **Parenteral medication**

Medicines to be added to infusion fluids or administered as a continuous infusion must be prescribed in the neonatal intensive care unit (NICU) daily infusion chart. Medicines to be administered, as discrete doses, must be written in the relevant section of the prescription chart.

4. 8  **Regular prescriptions**

The times for administration must be clearly indicated by circling the pre-printed times on the prescription chart or by writing the times using the 24 hour clock and circling them.

4. 9  **Allergies/adverse drug reaction**

The prescriber is responsible for recording in the appropriate section of the prescription chart medicine ‘allergies’ or clinically significant adverse reactions. A prescriber or a pharmacist must complete this before any medicine is administered. Adverse reactions must be recorded in the medical notes.
5.0 ADMINISTRATION OF INTRAVENOUS MEDICINES

Nurses and doctors must be aware of the baby's plan of care and care pathway to allow for safe administration of medicines or in the event of non-administration of a prescribed medicine, whatever the context.

5.1 Preparation and administration

If in any doubt about a prescribed medicine, the health care professional must a) confirm the prescription with the original prescriber; and/or b) check with the clinical pharmacist; and c) if still in any doubt, they must not administer the medicine. They should inform the prescriber, if possible; discuss and agree the appropriate action with the registrar; and where a prescribing error has occurred complete a clinical incident form.

5.1.1 Non-administration or late administration of medicines

If a prescribed medicine is not administered the reason must be recorded in the prescription chart by using the appropriate code in the appropriate box. The reason for non-administration must also be documented in the nursing notes plus the action taken, and inform the appropriate prescriber. Depending on the reason for non-administration, the medicine may be discontinued; a change in the dose or frequency may be required; an alternative route of administration or an alternative medicine may be prescribed.

It is important that medicines are administered on time. If a medicine is administered late, the administration time should be recorded on the prescription chart and the reason documented in the nursing notes. However, it is recommended that medicines that are more than 2 hours late should be re-prescribed so that subsequent doses are given at an appropriate interval (NPSA, 2007).

5.2 Competence

Health professionals who are involved in medicines management must understand the therapeutic uses of medicines administered to neonates, and includes the following:

- Why the drug is prescribed
- The action of the drug
- The correct dose range, concentration and volume to be administered
- Frequency of administration
- Potential side effects
- Associated hazards
- Route of administration
- Drug interactions
- Compatibility with other medicines

(NMC 2010; NPSA 2007; Audit Commission 2001).

When health professionals are unfamiliar with a prescribed medicine they must refer to an appropriate up to date reference source, such as the information in the current neonatal intensive care drug information folder, the current British National Formulary for Children (cBNF) and/or the clinical pharmacist or contact Medicines Information.

5.3 Requirements

a) Bolus administration

- White plastic drug administration tray.
- 1st and 2nd checker to wear red drug administration tabard
- Prescription chart
- Prescribed medicine
- Diluent if required
- Sodium Chloride 0.9% or compatible flush, as saline is sometimes not compatible for IV flush
- Pre-injection swabs
Luer-lock Syringes
Smart site (or equivalent)

b) Continuous or intermittent administration White plastic drug administration tray.
   1st and 2nd checker to wear red drug administration tabard
   
   - Prescription chart
   - Prescribed medicine
   - Diluent if required
   - Sodium Chloride 0.9% or compatible flush as saline is sometimes not compatible for IV flush
   - Pre-injection swabs
   - Appropriate sized luer-lock syringes
   - Appropriate medical device for the delivery of intravenous medications
   - Appropriate intravenous administration set(s), extension set(s) depending on the method and route of administration and the medical device used
   - A variety of connectors with a luer-lock may be used
   - Colour coded additive labels

5. 4 The administration procedure
Two registered nurses/midwives are required to prepare and administer intravenous medicines to neonates. Both nurses must check the identity of the baby, prepare and administer and be present at the baby’s cot-side throughout the medicines administration process. Nurses should prioritise and plan dedicated time for the preparation and administration of medicines and not allow interruptions, as this can increase the risk of medication errors (NPSA, 2007; Adcock, 2001). A red drugs administration tabard must be worn by both practitioners to demonstrate to other members of the neonatal team that they must not be disturbed.

5. 4.1 Infection prevention and control
Infection prevention and control principles (NUH, 2016) must be adhered to throughout the preparation and the administration of prescribed medicines:

   - Wash and dry hands thoroughly or use antiseptic hand gel prior to the preparation of the medicines to be administered and on completion of each administration episode
     A non-touch technique in combination with non-sterile gloves is used when medicines are administered via a peripheral line
   
   - An aseptic non-touch technique in combination with sterile gloves must be used when medicines are administered via central lines, which includes percutaneous long line, broviac catheter or umbilical venous catheter

5. 4.2 Role and responsibility of checkers
   Both 1st and 2nd checkers must individually check the prescription and then together, both checkers must read and check the prescription chart together. The 1st checker who is to administer the medicine should read aloud from the prescription chart and the 2nd checker should listen and visually check the prescription chart. Both checkers must independently calculate that the dose of the medicine prescribed is correct and the volume of medicine to administer, and agree this.

5. 4.3 Identification of baby
   - Name of the baby: prescription chart and identification band
   - Date of birth: prescription chart and identification band
   - Hospital number: prescription chart and identification band. All babies <32 weeks gestational age must have two identification bands attached to their incubator. All babies >32 weeks gestational age must wear two identification bands on each leg. This may be contra-indicated in exceptional circumstances (e.g. oedema)
Check the K number on the baby’s identification wrist band

5. 4.4 Prescription chart
- Weight, check current weight and/or weight when the medicine was initially prescribed
- Date of birth and gestational age if appropriate
- Name of the medicine to be administered
- The dose prescribed
- The route of administration
- The start date
- Additional instructions
- Signed by prescriber, name printed and professional group identified
- Date and time medicine is due is circled
- Time when the last dose was administered
- Has the medicine already been given?
- ‘Allergy’ box must be completed
- ‘Other cards in use’ box completed

5. 4.5 The medicine to be administered
- Check name of medicine prescribed
- Check strength of medicine
- Check expiry date of medicine
- Ensure that there is no evidence of discoloration or particles present
- If a diluent is required, check type of fluid, strength, volume required and expiry date. When a diluent is required, this must also be calculated independently. Errors made when calculating doses may be compounded when calculating the volume of liquids needed for the dose (NPSA, 2007).
- IV compatibility must be checked when multiple medicines are being administered
- Both 1st and 2nd checkers must independently calculate that the dose of the medicine prescribed is correct and the volume of medicine to administer, and agree.

5. 4.6 Bolus administration
A bolus administration of a medication is preferred when optimum serum levels are rapidly required or when the medicine is unstable in solution. It is essential to consider what fluids/medication is currently being infused via the peripheral line to be used; and whether it is appropriate to use the line or not. Further guidance is available in the neonatal drug information folder. Methods that may be used for a bolus administration of a medicine:-

a) Via a peripheral IV cannula (is being used for a continuous infusion)
- Prior to administration note and record the in-line infusion pressure
- Switch off (or pause) the infusion device prior to the medication administration. Do not use the roller-clamp on the administration set, as an increase in pressure may occur, this prevents an inadvertent bolus being administered
- Clean the designated injection port with a pre-injection swab and allow drying to occur for 30 seconds
- Check what fluids/medication is currently being infused via the line and whether it is appropriate to flush the line or not. Administer the prescribed flush slowly, usually sodium chloride 0.9%, (or compatible flush) in order to check patency of the line, and to avoid IV incompatibility. Administer the prescribed medicine slowly over the appropriate time via the designated injection port and repeat flush. Refer to the neonatal drug information folder for further guidance.
- If multiple medicine administration is required, flush between each medicine administered and on completion of the medicines administration. Consider if the compatible flush should be administered at the same rate as medicine administered.
Switch on (or cancel pause) the infusion device, and together with the second checker check that the infusion rate set is correct. Record in the fluid balance section of the intensive care chart.

b) Via a peripheral venous cannula (not being used for a continuous infusion)

- Ensure that the in-line clamp on the short T-extension set is open
- Clean the designated injection port with a pre-injection swab and allow drying to occur for 30 seconds
- Administer the prescribed flush slowly, using a compatible flush in order to check patency of the line, and to avoid an IV incompatibility.
- Administer the prescribed medicine slowly over the appropriate time via the designated injection port and repeat flush. Refer to the neonatal drug information folder for further guidance.
- If multiple medicine administration is required, flush between each medicine administered and on completion of the medicines administration. Consider if the compatible flush should be administered at the same rate as medicine administered.

c) Bolus administration of gentamicin

Gentamicin is administered at extended dosing intervals, 24 or 36 hours, to compensate for the renal immaturity of neonates. The evidence is that dosing schedules can result in errors in the frequency of medicines administration with potentially dangerous consequences to the baby (NPSA, 2007). Both 1st and 2nd checkers must individually check the prescription and then together, both 1st and 2nd checkers must read and check the prescription chart together, refer to section 5. 4.2, and check the following:

- Use the 24 hour clock to check and confirm when the gentamicin is due to be administered
- Specify the date and time that the last dose of Gentamicin was administered. Both 1st and 2nd checker must confirm this independently
- Are serum gentamicin levels due?
- If serum gentamicin levels already done, check results
- Is urinary output within a normal range?
- Confirm with prescriber if dose needs to be altered and new prescription is required

5. 4.7 Infusions

Neonates who require intensive care often have complex medication regimens. It is essential that when intravenous medication administration systems and fluids are to be renewed that nurses are well prepared in advance to ensure safe, effective, and competent practice with minimum disturbance to the baby. Continuous infusions are used where the medicine would be quickly metabolised and excreted; the medicine is added to a large volume of fluid for slow continuous infusion to ensure prolonged constant plasma levels.

In addition to the guidance in section 5. 4.5 the medicine to be administered, also consider the following:

- Check appropriate fluid and concentration
- Check correct dose calculation
- Check correct rate of infusion
- Check appropriate route to be administered
- Check IV compatibility with other infusates ‘running’ in the same line

a) Central lines: changing fluids and continuous drug infusions

- All changes of IV administration systems and manipulation of central lines should be kept to a minimum.
A surgical trolley should be cleaned and correctly set-up with all required items on the lower shelf of the trolley and a bag attached to the side. This prevents and minimises medication errors and bacterial colonisation of lines.

An aseptic non-touch technique must be used when medicines are administered via central lines. The 1st nurse should wash and dry hands and use antiseptic hand gel, and then put on sterile gloves.

Intravenous administration set(s), extension set(s) and appropriate luer-lock connectors to be used should be primed with the prescribed fluids/drug infusions and clearly labelled using the appropriate colour coded labels.

Prior to switching off the existing infusion, record in the fluid balance section of the intensive care chart the readings on each medical device used.

The 2nd nurse isolates the lines and connectors for the 1st nurse and cleans incubator portholes with Clinell Alcoholic 2% Chlorhexidine swabs.

First nurse cleans lines and connections with Clinell Alcoholic 2% Chlorhexidine swabs and allows drying to occur for 30 seconds.

Clamp central line: use the in-line product clamps only; the broviac catheter has an area with a protective clamping sleeve with clear instructions on where to clamp the line; a percutaneous long line should be clamped with care as the tubing can be easily damaged.

The 1st nurse disconnects the administration set and is given the new administration set by the 2nd nurse; together both nurses re-check labels and agree that it is the correct administration set and fluids/drug infusion; 1st nurse connects the new administration set, and ensures that luer-lock connectors are tightened.

If multiple fluids/drugs are being administered, one administration set should be changed at a time to prevent a medication error.

When ready to change the second administration set, the 1st nurse prompts the 2nd nurse; 1st nurse disconnects the second administration set and is given new administration set by the 2nd nurse; and together both nurses re-check labels and agree that it is the correct administration set and infusion fluids; 1st nurse connects new administration set.

If multiple IV infusions are being administered, one administration set should be changed at a time to prevent a medication error.

Once each infusion has been changed and set up, switch on/press start the infusion device used; the 1st and 2nd checker should document in the fluid balance section of the intensive care chart the new readings, if applicable.

Final check: correct drug, concentration, solution, volume and expiry date, and infusion rate set is correct.

Sign intravenous infusion prescription chart.

b) Peripheral lines: changing fluids and continuous drug infusions

A non-touch technique in combination with non-sterile gloves is used when medications are administered via a peripheral line.

When changing intravenous administration set(s), and setting up IV fluids and drug infusions, all IV administration systems should be primed with the new prescribed medications/fluids and clearly labelled using the appropriate colour coded labels.

Prior to switching off the existing infusion, record in the fluid balance section of the intensive care chart the readings on each medical device used.

Clean around the designated connector using Clinell Alcoholic 2% Chlorhexidine swabs and allow drying to occur for 30 seconds.

The 1st nurse disconnects the administration set; together both nurses re-check labels and agree that it is the correct administration set, prescribed drug and solution; connects new administration set, and ensures that luer-lock connectors are tightened.

If multiple IV infusions are being administered, one administration set should be changed at a time to prevent a medication error.

Once each infusion has been changed, switch on/press start the infusion device used; the 1st and 2nd checker should document in the fluid balance section of the intensive care chart the new readings, if applicable.

Final check: correct drug, concentration, solution, volume and expiry date, and infusion rate set is correct.

Sign intravenous infusion prescription chart.
c) Peripheral lines: Intermittent fluid/drug infusion (may have an infusion ‘running’)

Intermittent infusions are used to avoid venous irritation or toxicity. The medication is added to a small volume of fluid for slow infusion over a limited period of time.

- A non-touch technique in combination with non-sterile gloves is used when medications are administered via a peripheral line.
- The appropriate medical device used to deliver an intermittent IV medication should be ready for use.
- When drawing up the volume of fluid/drug to be administered allow a 2ml overage, you must refer to the specific neonatal drug monograph in the current neonatal drug information folder.
- Prime system with the prescribed drug and solution for infusion and clearly label using the appropriate drug label.
- Both nurses together set-up the syringe pump and check that the pump recognises the syringe size used.
- **Switch off/pause** the existing continuous infusion device prior to the administration of the medication.
- Clean the designated injection port or appropriate connector to be used with Clinell Alcoholic 2% Chlorhexidine swabs and allow drying to occur for 30 seconds.
- If infusion ‘running’, check what prescribed medication and solution is currently being infused via the line to be used and consider whether it is appropriate to flush the line or not. Administer the prescribed compatible flush slowly, in order to check patency of the line and to avoid a drug interaction.
- Check the rate that the compatible flush is to be administered; guidance is available in the neonatal drug information folder.
- Connect the new IV system and prescribed medication.
- **Final check:** both nurses check that it is the correct drug, concentration, solution, volume and expiry date, and the volume to be infused (VTBI) is set correctly.
- **Switch on/start** the new infusion.
- When the administration of the prescribed medication and solution for infusion is complete the medical device will have an audible alarm to alert the nurse that the infusion is complete.
- **Disconnect the IV administration system and remove immediately**.
- Administer the prescribed flush via the designated injection port. **Do not** flush via the administration system as this would result in an overdose.
- **Switch on** the continuous infusion (if one is ‘running’) both nurses again check that it is the correct drug, concentration, solution, volume and expiry date, and set rate is correct.
- Document in the fluid balance section of the intensive care or high dependency chart.
- Sign prescription chart /intravenous infusion prescription chart.

6.0 SPECIFIC POINTS

- Explain to parents/carers, if present, that you are about to administer their baby's medicine(s) and offer relevant written information if available.
- Avoid disturbing the baby and only reposition baby, if necessary depending on the route of administration. It is essential to be aware of baby’s behavioural and physiological cues, minimise any handling, and allow the baby to recover before continuing with any intervention.
- All clamps on intravenous administration sets must be closed before removing the administration set from the infusion pump, or switching pump off. This is required regardless of whether the administration set has an anti-free flow device (National Patient Safety Agency, 2010).
Infusions when discontinued must be removed immediately to prevent and minimise the risk of medication errors.

When a syringe pump is used to administer intravenous fluids or medicines to neonates, a bag of fluid should not be left connected to the syringe as this can cause an over infusion of fluid or medicine (National Patient Safety Agency, 2010). This action does not apply to the administration of blood components to neonates. These should continue to be administered as per The British Committee for Standards in Haematology ‘Guidelines on the Administration of Blood Components’ (2009).

Once a medicine is drawn up, it should never be left unattended or unlabelled.

Intravenous sites must be inspected hourly for signs of infection, evidence of extravasation or for signs of leakage around the cannula/catheter, and record the neonatal visual infusion phlebitis score (VIPS) in the intensive care or high dependency chart.

The set-up of a medical device used to deliver a prescribed medicine includes: the selection of the correct medical device; the selection of the correct make and syringe size, and that it is recognised by the syringe pump to be used, the correct administration set with in-line pressure sensor, appropriate extension sets and luer-lock connectors.

When a syringe pump is used to administer fluids or drugs it is important to use the purge facility on the pump. The administration system used must not be connected to the baby at this point; this ensures that the ‘slack’ in the administration system/tubing is removed to ensure that small volumes are administered to the baby in a timely way. This procedure can also be performed manually, again when the system is not connected to the baby.

Use appropriate drug labels for bags or syringes containing prescribed medications, and use correct drug labels for infusion lines.

Intermittent administration: When drawing up the volume of fluid/drug to be administered allow a 2ml overage, you must refer to the specific neonatal drug monograph in the current neonatal drug information folder.

Both nurses together check: volume to be delivered is correct, rate set is correct, and when the medical device used is a syringe pump check that the syringe make and size is recognised otherwise a medication error occurs.

Medical devices used for the administration of medicines have the facility to monitor in-line infusion pressures. The acceptable range in the neonate is 50 mmHg above the baseline reading.

Note and record the in-line infusion pressure reading in the intensive care or high dependency chart prior to a medicines administration or when changing intravenous infusion fluids and administration systems. Infiltration can occur without an increase in the in-line infusion pressure.

Check what fluid/medication is currently being infused via the line to be used and consider whether it is appropriate to flush the line or not. Guidance is available in the neonatal drug information folder.

Administer the prescribed compatible flush slowly, in order to check patency of the line, and to avoid an IV incompatibility. The compatible flush should be administered at the same rate as the medicine that has been administered, further guidance is available in the neonatal drug information folder.

Both checkers should undertake a final check: that it is the correct fluid/drug, concentration, solution, volume and expiry date, infusion rate set is correct and the correct line is being used.

Both checkers must sign the prescription chart; for infusions sign the IV infusion prescription chart.

Flushes must be prescribed on the prescription chart stating a maximum volume. Flush volumes can significantly add to a neonates total volume intake. If the volume of flush administered is to be included in a baby’s fluid balance, this should be agreed during the daily review by the consultant and documented in the care plan, recorded in the fluid balance section of the intensive care chart or high dependency chart.

Medicines that are an irritant must be administered cautiously and over the period of time recommended by the manufacturer; guidance is available in the neonatal drug information folder.
Nottingham Neonatal Service Guidelines

- Medicines that are supplied via CIVA service should be administered in their existing syringes.
- Use the appropriate occlusive, clear sterile dressing to cover the cannula/catheter and ensure that skin integrity is maintained. Dressing used should allow visual inspection of the entry site; check that the dressing/strapping is secure and safely applied to the babies’ skin; check regularly that dressing/strapping does not damage babies’ skin, does not cause pressure or compromise circulation for example, to fingers or toes.
- Remove all used items and ensure that syringes and needles are disposed of in the sharps bin.
- Baby should be positioned in a developmentally supportive position.
- Medicines should not be added to blood, blood products, mannitol or Sodium Bicarbonate.
- Boluses and intermittent infusions must not routinely be administered via a central venous catheter (peripheral long line or a broviac catheter). This route may be considered only when alternative venous access is unavailable or when specifically requested, and must be discussed and agreed with a Consultant (NNS, G3, 2005).
- A 5-10 ml syringe must be used when bolus or intermittent medicines are administered via a central catheter. It is preferable that this size is used to reduce the risk of central venous lines rupturing, if the infusion pressure exceeds 25 psi (NNS G3, 2005). However, medicines that are provided via CIVA service should be administered in their existing syringes.
- Blood may be administered via one lumen of a double lumen UVC.
- Blood may be administered via a broviac catheter only when alternative venous access is unavailable (NNS G3, 2005).
- Blood cannot be administered via a peripheral long line, as the lumen is too narrow (NNS G3, 2005).
- Check for the presence of air bubbles. Inadvertent administration via central access may result in air embolus and fatality.
- The umbilical arterial catheter (UAC) should not generally be used for administration of medicines, except heparinised saline to keep the line open. However, in an emergency it may be necessary to administer medicines via the UAC but must always be discussed with a consultant.

7.0 OBSERVATION AND MONITORING

Doctors and nurses involved in medicines administration should know and review the baby’s agreed care plan or care pathway regularly across each 24-hour period.

- Monitor and document agreed physiological parameters and know acceptable ranges.
- Observe the clinical status of the baby for adverse medicine reaction prior to, during and following a medicines administration.
- Incompatibilities between medicines can cause precipitation and inactivation. This reaction is not always visible, and therefore, the compatibility should always be checked by referring to the neonatal drug information folder or if still in any doubt contact the clinical pharmacist or medicine information.
- There is an increased risk of infection due to breach of skin integrity and manipulation of lines and connections. Clinical observations should include signs of local (VIPS scores) and systemic infection.
- In-line infusion pressures must be monitored and recorded hourly. When an infusion is in progress, and prior to a medicines administration, note and record the in-line pressure reading on the infusion pump.
- Infiltation can occur without an increase in in-line infusion pressure. Therefore, intravenous cannula sites should be inspected, visually, hourly and more frequently if an irritant medicine is being infused (VIPS scores).
- Acceptable neonatal range for in-line infusion pressure is 50 mmHg above the baseline reading.

8.0 AUDIT POINTS
Drug related incidents
Audit care plan and pathway
Audit of prescription charts
Audit of medicines administration process
Visual infusion phlebitis score (VIPS)

9.0 RESOURCES


Nottingham University Hospitals (2011 ** Currently being updated) Medicines Code of Practice: Administration of Medicines. Nottingham University Hospitals NHS Trust


Nottingham Neonatal Service (current) Neonatal Drug Information folder. Nottingham University Hospitals NHS Trust

Nottingham University Hospitals (2016) Infection Prevention and Control Policy. Nottingham University Hospitals NHS Trust


9.1 Online resources

British National Formulary Children www.bnfc.org

British Committee for Standards in Haematology www.bcshguidelines.org/pdf/Admin

Department for Education & Skills www.dfes.gov.uk

Department of Health (England) www.dh.gov.uk

Evidence-based Practice in Infection Control www.epic.tvu.ac.uk

Health and Safety Executive www.hse.gov.uk

Medicines Code of Practice: Administration of Medicines http://nuhweb/staff-portal.htm Click on Working at NUH, and then click on Policies and Trust Wide Procedures

National Patient Safety Agency www.npsa.nhs.uk

National Patient Safety Agency Right patient, Right blood www.npsa.nhs.uk

National Institute for Health and Clinical Excellence www.nice.org.uk
REFERENCES

Nottingham Neonatal Service (Current) Neonatal Drug Information. Nottingham University Hospitals NHS Trust

Nottingham University Hospitals (2016) Infection Prevention and Control Policy. Nottingham University Hospitals NHS Trust


Nottingham University Hospitals (2011** currently being updated) Medicines Code of Practice: Administration of Medicines. Nottingham University Hospitals NHS trust.


Department of Health (2006) Standards for better Health. The Department of Health


