Preceptee Name:

Paediatric Nursing Preceptorship Programme

# MEDICINES MANAGEMENT: SUPPORTIVE BOOKLET

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# Contents

# Legal aspects of medicine management

Medicine's management is an integral part of the nursing role. The RCN (2020) define medicines management as "The clinical, cost effective and safe use of medicines to ensure patients get the maximum benefit from the medicines they need, while at the same time minimising potential harm." Effective medicine's management places the patient as the primary focus to ensure they receive safe and effective care. The Nursing and Midwifery Council (NMC) standards of proficiency for registered nurses and the NMC standards of proficiency for nursing associates outline the roles and responsibilities in the administration of medicines therefore it is important you have read and understood the applicable document to your practice.

All aspects of practice involve risks and medicines management in no exception to this regardless of the type of drug or the route of administration. Therefore, it is important to have a clear understanding of the legal aspects involved in medicine's management to minimise such risk, to protect your patients and to ensure you are acting in line with your professional duty under the NMC code. As a Registered Nurse or Nursing Associate, the NMC code is clear that you are personally accountable for your own practice and that you have a duty of care to always act in the best interest of patients. This includes your responsibility under duty of candour that you must be open and honest and inform those in your care if an error through an act or omission has occurred. Where a deviation from this duty of care arises and actual harm is caused to a patient, clinical negligence claims can be made. Where claims are made against errors that have occurred due to issues or processes that have failed to prevent it (e.g. faulty equipment) the employer will be liable. However, mistakes that occur due to an individual acting outside their level of competence can lead to individual nurses being directly liable. When it is unclear who holds liability for the patients harm, the Bolam principle can be applied. This principle states this if an individual acts in accordance with practice that is accepted as appropriate by a body of peers (i.e. those with the same experiences, qualifications and working within the same situation), they cannot be held as negligent. Clinical negligence claims cost the NHS billions each year and it is anticipated that this is a figure will rise as an increasing awareness and number of patients who are prepared to challenge the standard of care received. It is therefore important you are familiar with using and accessing guidance that supports and identifies your accountability in your clinical practice.

There are four main areas of law in which clinical negligence claims can be made. These are identified below to demonstrate how professional accountability can be determined.

| Type | Description | Examples |
|---|---|---|
| **Criminal Law** | Law that holds an individual/s as accountable to the public | * the administration of a drug by the wrong route and resulting in the death of a patient |
| **Civil** | Law that allows an individual to hold another individual as accountable | * if negligence is implicated in the cause of injury or death |
| **Employment law** | Law that holds an individual accountable to their employer | * when an individual has consistently performed below of their employers expectations |
| **Public law** | Law that holds the individual accountable to their profession (such as the NMC) | * failure to comply with professional standards |

The NMC Code details the required standards for nurses for medication management under the preserve safety domain stating that nurses will 'advise on, prescribe, supply, dispense or administer medicines within the limits of your training and competence, the law, our guidance and other relevant policies, guidance and regulations'. By recognising your professional accountability, recongising your limits of competence, ensuring you receive the correct training and through working within the law, policies, procedures and guidance this will ensure you are working to the standards of the NMC code and ensure the safety of everyone in your care.

One way of making sure any medicine you administer is safe for your patient, is to follow the "6 rights" of medicine management:

1) Right patient
2) Right time
3) Right drug
4) Right dose
5) Right route
6) Right documentation

You must also monitor the patient appropriately following administration and during ongoing treatment, reporting suspected adverse effects to medical staff responsible for the patient's care.
You have a duty to understand why the patient is receiving each medication, the different indications for each drug, side effects, cautions and computability with other medications and treatments. You must also ensure the patient is sufficiently informed about each of the above. You must take al steps to ensure all mediations are stored securely.

It is important to recognise that" prescribing is not within the scope of practice of everyone on our (the MC) register. Nursing associates don't prescribe, but they may supply, dispense and administer medicines. Nurses and midwives who have successfully completed a further qualification in prescribing and recorded it on our (the NMC) register are the only people on our (NMC) register that can prescribe".

You must consult the NMC Code and follow this at all times.

# Anaphylaxis

Anaphylaxis is a life threatening condition that involves an individual experiencing a rapid, generalised or immunological reaction to a substance to which the patient has become sensitised to (Resuscitation Council UK 2021). This is different from experiencing an allergic reaction, in which symptoms are not life threatening, are milder and more localised (e.g. individual presents with a rash or itching).

However, if a patient has an allergy to an allergen such as an ingredient within a medicine, they ***can*** be at risk of developing anaphylaxis if exposed to this same ingredient in other medicines e.g. a penillicin allergy could cause anaphylaxis if the individual was given any penicillin based antibiotic.

The pathophysiology of a true anaphylaxis reaction often follows a second or subsequent exposure to the allergen. This is because the initial contact to the allergen causes the individual to develop IgE antibodies (a protein that recognises allergens as foreign body). When the individual has a subsequent exposure to the allergen, the IgE antibodies trigger a rapid release of chemicals that instigate a systemic reaction that causes an extreme inflammatory response as the body "fights" the allergen. This leads to vasodilation and increased vascular permeability, increased heart rate and cardiac contraction, bronchocontriction and pulmonary vasoconstriction.

Signs of anaphylaxis therefore include:

- Obstructed airway
- Breathing difficulties (from the airway obstruction)
- Cardiovascular collapse (hypotension and tachycardia)
- Mucosal changes and skin rashes
- Gastrointestinal disturbance (vomiting)

Presentation of anaphylaxis usually occurs within minutes of the individual's exposure to the allergen. However delayed reactions are possible. Once an anaphylactic reaction occurs, if left untreated, the individual will become unconscious and die.

Another type of similar reaction, called an ***anaphylactoid*** reaction occurs on the first exposure to an allergen. The individuals response unlike anaphylaxis in not immunological, but is related to the rate to which the medicine is administered. Rapid administration of the medicine causes a release of chemicals such as histamine cause flushing of the individual's skin. This flushing has given rise to the name of "redman syndrome" to describe a common sign of this reaction. Whilst this reaction has a different name, the presentation and the treatment will be exactly the same as an anaphylactic reaction.

The management of anaphylaxis depends on the severity of the reaction, but you should always follow the resuscitation council's pathway (below) to guide your actions (N.B there is a separate algorithm for refractory anaphylaxis) . A severe reaction should be treated as a medical emergency and prompt action is vital.

Whilst not always possible, prevention and preparation for anaphylaxis should be undertaken when administering any medication. This includes being aware of the patient's medical history and past reactions/experiences during drug administration and understanding the side effects of drugs that may evoke anaphylactoid reactions.

Resuscitation Council UK

GUIDELINES 2021

# Anaphylaxis

## Anaphylaxis?

A = Airway B = Breathing C = Circulation D = Disability E = Exposure

### Diagnosis – look for:

- Sudden onset of Airway and/or Breathing and/or Circulation problems[1]
- And usually skin changes (e.g. itchy rash)

### Call for HELP

Call resuscitation team or ambulance

- Remove trigger if possible (e.g. stop any infusion)
- Lie patient flat (with or without legs elevated)
  - A sitting position may make breathing easier
  - If pregnant, lie on left side

### Give intramuscular (IM) adrenaline[2]

Inject at **anterolateral aspect** – middle third of the thigh

- Establish airway
- Give high flow oxygen
- Apply monitoring: pulse oximetry, ECG, blood pressure

### If no response:

- Repeat IM adrenaline after 5 minutes
- IV fluid bolus[3]

**If no improvement in Breathing or Circulation problems[1] despite TWO doses of IM adrenaline:**

- Confirm resuscitation team or ambulance has been called
- Follow REFRACTORY ANAPHYLAXIS ALGORITHM

**1. Life-threatening problems**

**Airway**
Hoarse voice, stridor

**Breathing**
↑work of breathing, wheeze, fatigue, cyanosis, $SpO_2$ <94%

**Circulation**
Low blood pressure, signs of shock, confusion, reduced consciousness

**2. Intramuscular (IM) adrenaline**

Use adrenaline at 1 mg/mL (1:1000) concentration

| | |
|---|---|
| **Adult and child >12 years:** | 500 micrograms IM (0.5 mL) |
| **Child 6–12 years:** | 300 micrograms IM (0.3 mL) |
| **Child 6 months to 6 years:** | 150 micrograms IM (0.15 mL) |
| **Child <6 months:** | 100–150 micrograms IM (0.1–0.15 mL) |

The above doses are for IM injection **only**.
Intravenous adrenaline for anaphylaxis to be given **only by experienced specialists** in an appropriate setting.

**3. IV fluid challenge**

Use crystalloid

| | |
|---|---|
| **Adults:** | 500–1000 mL |
| **Children:** | 10 mL/kg |

# Safe administration of non intravenous medicines – process overview

| Action | Rationale |
|---|---|
| Check the prescription for correct drug/fluid name, dose, route, patient, for any allergies and time last given or due to be given and if any have to given on full or empty stomach (if oral drug) | To confirm suitability of medicine administration |
| Ensure patient/family aware of need to administer medicine | To gain informed consent/assent from patient and family |
| Check if patient is currently receiving medicine i.e. check if nil by mouth, have eaten/not eaten (if applicable) | To determine suitability of administering medicine |
| Prepare your environment for drug/fluid administration:<br>• Clean hands<br>• Gather all the equipment you will need to prepare the medicine<br>• Check any drug/fluids against prescription and formulary and confirm if further diluents are needed, compatible solutions, side effects, contraindications, stability/storage needs (have they been met?) and duration of administration<br>• Check any drug/fluid expiry dates and if premade, inspect content for signs of tampering (cracks or puncture marks), discoloration or sediment<br>• Perform any medicine/fluid calculations (in silence) and separately from second checker (if required) | To ensure that you have everything you need to safely prepare the medicine/fluid prescribed<br><br>To ensure that the medicine/fluid is safe to administer<br>To ensure full concentration is used during calculations |
| Prepare medicine/fluids are per prescription and manufacturers/formulary instructions | To ensure the medicine/fluid is prepared for as per evidence based practice |
| With second checker (if applicable), prepared medicine and prescription chart to patient bedside and confirm patient's identity against prescription chart and name band. | To ensure patient receives correct medicine/fluid |
| Confirm patient ready/available to receive medicine and administer medicine as per prescription and instructions | To ensure medicine is administered safely |
| Dispose of any single use equipment as per Trust policy | Safe disposal of clinical waste. Prevention of cross infection |
| Document administration (or omissions) in appropriate documentation e.g. drug chart | To ensure that future doses can be administered safely |

# Fluid balance

Fluid in the body is held either within the cells or within a circulatory system in the body. The amount of fluid in each is balanced through fluid moving in and out of the cells and circulatory systems by osmosis. The administration intravenous fluids (and enteral) involves careful monitoring of the patient to ensure that they are not receiving too much or too little fluid, according to their individual needs. Different types of IV fluid are therefore administered to maintain or restore the individual's natural fluid balance.

A risk of giving too much fluid or fluid that contains too little or too much of certain electrolytes can cause pulmonary oedema and the further loss of important electrolytes that help regulate and maintain many important body functions.

When caring for individuals requiring intravenous fluids; you must undertake thorough assessments of their fluid needs before and during the administration of prescribed fluids. This includes:

- Taking and recording heart rate, blood pressure, temperature and noting any clinical features of oedema or dehydration (looking at skin integrity, fontanelle status etc)
- Measuring urine output and regular calculation of patients fluid balance (comparing fluid intake against fluid output)
- Daily weights
- Serum electrolyte levels (blood sampling)
- Monitoring of blood glucose levels

**Electrolytes**

Electrolytes are chemicals (ions) found in your body and maintain important bodily functions such as regulating heartbeat. The more common electrolytes you will come across include calcium, magnesium, potassium, sodium, phosphate and chloride. This can be included in the fluids you administer to help treat any abnormal electrolyte levels. It is important that you **NEVER** administer neat electrolytes; they must always be diluted as instructed (check Children's BNF and manufacturer's instructions).

**Fluid calculations**

Calculations for the normal fluid requirements of a child (also known as "maintenance") are calculated using the patient's weight in the following formula:

(100 ml for each of the first 10kg) + (50ml for each kg 11-20) + (20 ml for each additional kg) / 24hour

**Example**: If a child weighs 25kg, their maintenance fluids would be:

(100mL x 10kg) = 1000mL

1000 + (50mL x 10kg) = 1500mL

1500mL + (20mL x 5kg) = 1600mL (in 24 hours)

1600 / 24hrs = 66.67mL/hr (or 67mL/hr)

*** Your go ***

Using the following weights, calculate the patients total maintenance fluid:

- 6kg
- 32kg

**Important** The following sections are all for information purposes *only* and for practicing the calculation component of drug administration. This is not a competency assessment for being able to administer Intravenous drugs or fluids of any type. You must complete your employing trusts Intravenous medication management training course and competency assessment which is all done through your employer and line manager. The WPNPP does not currently provide any training for intravenous drug administration and management. This must be completed within your employing trust.

**Reconstitution/Dilution and rate of administration**

Medicines and fluids are available in a variety of different forms/mediums, such as pre diluted ampules, vials and bags, or as a dry powder that must be diluted with a compatible solution (also known as reconstituting) before use. It is the Registered Nurse's responsibility to check the form prescribed intravenous treatments carefully and determine whether further dilution is required. This displacement value accounts for the extra "space' taken up by the volume of powder once added to the powder. For example, you might add 10mls but the displacement value means that the total amount of solution mixed with the powder creates a total volume of 11mls. This value is therefore very important and must be considered when calculating the volume you require to administer the prescribed amount.

It is important to also note that any medicines you are administering may require additional dilution with a compatible solution before you can safely administer them. The failure to dilute some drugs can cause significant harm to your patients, including phlebitis, extravasation or, in the case of concentrated potassium chloride, cardiac arrest. Similarly, dilution with incompatible solutions or an inappropriate of administered can cause harm to the patient. Instructions on how to safely prepare and administer any medicine or fluid can be found in the Children's BNF or in the manufacture's leaflet. If you can not find clear information, you must contact your pharmacy department.

The rate of administration can be delivered as:

- a ***bolus*** - slowly administered over several minutes e.g. 3-5 minutes
- ***intermittent infusion*** – delivered over several minutes or a few hours e.g. 20 minutes or 2 hours
- ***continuous infusion*** - ranging from hours to days e.g. 24 hours

If infusional administration is required you must use your local intravenous therapy pumps but not before you have received training on how to use them safely. You must also be aware of when the intravenous giving set being used needs to be changed – this information can be gained from your local Trust policy.

Calculating the speed of administration through a pump is also a skill you must be familiar with. You can practice this in the drug calculation section.

# Drug calculations

An important of any medicine and fluid administration has two key purposes. As children are of varying weights, the amounts of either will be different for every child. However, medicines and fluids are manufactured in set amounts. Being able to carry out drug calculations will ensure that you are able to confirm the prescribe dose/amount is correct for your patient and to ensure that from the stock of medicines/fluids you have you administer the correct amount.

It is important that you always check the prescribed dose and frequency of administration in the Children's BNF. Any concerns or questions about the prescription must be discussed with the medical staff and the medicine should not be given. Even if the child has received the drug, it does not mean that it was correct.

**Unit conversion**

Commonly used medicines will be prescribed in milligram (mg) or microgram (mcg or µg) quantities, but the medicine will be dispensed in grams (g). For fluids, milliliters (mL) are often prescribed, but bags of fluids can be dispensed in litres (L). You will therefore have to be able to calculate the prescribed amount from the available volume

Remember:

| | | |
|---|---|---|
| 1 gram (g) | = | 1000 milligrams(mg) |
| 1 milligram (mg) | = | 1000 micrograms (mcg or µg) |
| 1 litre (L) | = | 1000 millilitre (mL) |

Therefore, to change from grams to milligrams, milligrams to micrograms or litres to millilitres, **multiply** the amount by 1000 and to change amounts from milligrams to grams, micrograms to milligrams or milliliters to litres, you **divide** by 1000.

e.g.

| **multiply** | | **divide** | |
|---|---|---|---|
| 4g | = 4000mg | 4500mg | =4.5g |
| 0.25g | = 250mg | 200mg | = 0.2g |
| 0.05g | = 50mg | 75mg | = 0.075g |
| 1mg | =1000 micrograms | 2400 micrograms | =2.4mg |
| 0.005mg | =5 micrograms | 150 micrograms | =0.15mg |
| 1.5 L | = 1500mL | 3100mL | = 3.1L |
| 0.6L | = 600mL | 255mL | = 0.25L |

*** Your go ***

| | | |
|---|---|---|
| 1440mg | = | g |
| 200micrograms | = | mg |
| 2450litres | = | mL |
| 4.75g | = | mg |

# Drug calculations

Sometimes your calculation may recreate an answer that has several decimal places. As syringes and pumps can only deal with 0.1ml increments, you need to be able to round your answer to the most appropriate answer; so to not over or under dose your patient.

The general rule is to round the number up if the decimal point is 5 or above, and we round down, if the decimal point is 4 or below.

e.g.

| | |
|---|---|
| 7.233mL | = 7.2mL |
| 1.588mg | = 1.6mg |
| 0.465g | = 0.5g |

*** Your go ***

| | | |
|---|---|---|
| 7.665mg | = | mg |
| 1.3333g | = | g |
| 1.1456mL | = | mL |
| 10.456mg | = | mg |

**General drug calculations**

The following formula can be used as an aid to work out the quantity of medicine of fluid you need to take from the available stock to obtain the prescribed amount:

$$\text{Volume/amount required} = \frac{\text{what you want}}{\text{what you've got}} \times \text{volume (available)}$$

e.g. You need to administer 200mg of pipercilliantazobactum. It comes in 2.25g in 10mL (when diluted)

How many mLs do you need?

1) Convert either the dose from mg to g or the vial amount from grams to mg (to allow you to calculate the volume of pipercilliantazobactum you will need.

   = 200mg = 0.2g or 2.25g = 2250mg

2) Carry out your drug calculation:

   0.2g / 2.25g x 10mL = 0.88mL (or 200mg/2250mg x 10 = 0.88mL)

3) Round your decimal to the nearest 0.1

   0.88mLs = <u>0.9mL</u>

# Drug calculations

You can also use this approach to calculate tablets or capsules prescribed.

e.g. You need to administer 3mg of dexamethasone. The stock available is 500 microgram tablets (i.e. 1 tablet provides 500 micrograms).

How many tablets do you need?

1) Convert with dose or tablet dose e.g. 3mg = 3000mg microgram or 500 microgram = 0.5mg

2) Carry out your drug calculation:

3000mg / 500microgram x 1 = 6 tablets (or 3mg / 0.5mg x 1 = 6 tablets)

3) No need to round your decimal as it is a whole tablet you need!

*** Your go ***

Calculate the amount (in mLs) you would need to draw up to give 23mg ranitidine. Drug comes in 75mg in 5mL.

Calculate (in mg) the amount you would need to draw up to give 115mg Teicoplanin. Drug comes as 200mg in 3mLs.

You need to give a dose of 750mg of paracetamol. The patient has asked for tablets. Each tablet are available as 500mg. How many tablets would you give?

# Drug calculations

**Confirming prescription calculations**

Many doses prescribed are based on the child's weight. You must be able to confirm the prescribed dose before calculating and administering any medicines.

e.g. The dose required is 4mg/kg (i.e. 4mg per kg). The child weighs 11kg.

The dose required = 4mg x 11kg = 44mg

Be careful to check if the dose per weight is related to each dose or if it is a total dose that the child can receive in 24 hours that must be split in smaller doses.

e.g. The dose required is 5mg/kg/24hours and 3 divided doses (or TDS). The child weighs 15kg

The dose required is 4mg x 11kg = 75mg/day

75mg / 3 = 25 mg /dose

*** Your go ***

What dose should be prescribed for a drug that should be 4mg/kg/day in two divided doses for a child weighing 17kg?

## Volumes

### Dilution

You may notice instructions in the Children's BNF or the manufacturer's instructions to dilute the drug amount further. You need to be able to use this information to safely dilute and administer the prescribed medicine or fluid.

e.g. A patient has been prescribed aciclovir. They require 450mg. You notice that the Children's BNF requests you dilute the final dose in a volume of water for injection or 0.9% Sodium Chloride that gives you a concentration of 5mg/mL.

What will be the total amount of fluid you will need to administer the aciclovir safely in?

450mg to be diluted in 5mg/mL = 450mg / 5mg = 90mL

# Drug calculations

*** Your go ***

What is the total volume a prescribed drug should be diluted up in to if the dose is 200mg and the final concentration should be 4mg/mL?

What is the total volume a prescribed drug should be diluted up in to if the dose is 5g and the final concentration should be 4mg/mL?

Sometimes the dilution instructions for a drug are expressed in different ways, for example:

Dilute 50:50 means dilute the drug solution with an equal volume of diluent, i.e. dilute 1mL drug solution with 1mL diluent to give 2mL.

Dilute 1 part with 4 parts means dilute 1 part drug solution with 4 parts diluent, i.e. dilute 1mL drug solution with 4mL diluent to give 5mL.

Dilute 1 in 20 means dilute 1 part drug solution to a total volume of 20 parts, i.e. dilute 1mLdrug solution with 19mL diluent to give 20mL.

**Percentage**

Drug concentration may be displayed as % (w/v). This simply means that the percentage is the number of grams dissolved in each 100mL of the solution.

e.g. 0.9% Sodium Chloride means that 0.9g of Sodium Chloride is dissolved in each 100mL of the fluid

Sometimes, a prescription requires you to draw up a certain amount of grams or milligrams from such solutions and so you must be able to convert the percentage value in to your drug calculation.

e.g. A patient is prescribed 2g of glucose to be given as glucose 5% injection.

What volume (mL) do you give?

1) 5% Glucose = 5g per 100mLs

2) 2g / 5g x 100mLs = 40mLs

# Drug calculations

*** Your go ***

In mLs, what is the volume you would need to administer 6g of a solution that comes in 4%?

**Ratio**

This form of volume is usually only used for measuring the concentration of drugs such as adrenaline (epinephrine). The concentration of these medicines is displayed as containing 1 in 1000 or 1 in 10000. This simply means that there is 1g in every 1000mL or 10000mL respectively.

e.g. How many mL would you need to give 1mg of adrenaline (epinephrine) using 1 in 10,000 vial?

1) Convert 1 in 1000 in to grams = 1g in 1000mL

2) Convert either available grams in to milligrams = 1g x 1000 = 1000mg (or milligram dose to grams 1mg / 1000 = 0.001g)

3) 1mg / 1000mg x 1000 = 1mL (or 0.001g/1g x 1000 = 1ml)

*** Your go ***

In mL, what is the volume you would need to administer 2mg of a 1 in 100 solution?

In mL, what is the volume you would need to administer 40mg of a 1 in 10000 solution?

# Drug calculations

**Infusion Calculations**

Some medicines and fluids are prescribed to be administered slowly, over several minutes or hours. The rate is often related to the potency of the solution so please always follow instructions as per Children's BNF and the manufacturer.

To administer a volume over an hour or more, you can simply use the volume amount of solution that needs to be given and **divide** it by the number of hours.

e.g. to administer 500mL over 4 hours

500mL / 4 hours = 125mL/hr

However, to administer a solution in less than an hour (i.e. over several minutes), you must work out how many of those minutes there are in 1 hours and **multiply** that number that the volume you need to give.

e.g. to administer 250mLs in 20minutes

In 1 hour there are 60 minutes. Within 60 minutes, there are 3 lots of 20 minutes ( 60 / 20 = 3 )

250 mL x 3 = 750mL/hr

*** Your go ***

You need to administer 1500mls of 0.9% Sodium Chloride over 24 hours, what rate do you set the pump at?

You need to administer an antibiotic over 15 minutes. You have made up the required dose in 50mL. What rate do you set the pump at?

You need to administer an drug over 1.5 hours. You have made up the required dose in 30mL. What rate do you set the pump at?