


SAFE DRUG ADMINISTRATION

LEARNING PACKAGE FOR NURSES

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HUNTER NEW ENGLAND
NSW HEALTH

1 ORAL MEDICATION PACKAGE

1.1 A Review of Basic Calculations

The first steps in the administration of medication are knowing how to calculate the drug dosage and knowing the units of measurement most commonly used when a medication order is written for a patient. This package covers the units that are most frequently encountered by nurses when dispensing oral medications to patients. The exercises are designed to refresh your practice. If you have difficulties with any of the assessments or would like some more practise, turn to the reading and reference list for the resources.

1.2 The Metric System

As you know, the units of measurement currently used in Australia are derived from the metric system, a system which is based on factors of ten. The basic units of the metric system are listed below.

- gram (g) - is the unit for measuring mass (weight)
- litre (L) - is the unit of measuring volume
- metre (m) - is the unit for measuring length

Prefixes are added to these basic units of measurement to indicate either a reduction or an increase in size. Commonly used prefixes in drug calculations include the following.

Prefix	*Scientific notation*	*Symbol*
micro (one millionth)	(10^{-6})	ug
milli (one thousandth)	(10^{-3})	m
kilo (one thousand)	(10^{3})	k

1.2.1 Converting Metric Units

In most instances the amount of the medication to be given will be smaller than the basic unit. Therefore you need to remember the following:

- 1 gram = 1000 milligrams (mg)
- 1 milligram = 1000 micrograms
- 1 litre = 1000 millilitres (ml)

1.2.2 Multiplications and Divisions

To multiply by:	**move the decimal point:**
10	One place to the right (eg. 2.5 x 10 = 25)
100	Two places to the right (eg. 2.5 x 100 = 250)
1000	Three places to the right (eg. 40.0 x 1000 = 40000)

To divide by:	**move the decimal point:**
10	One place to the left (eg. 2.5 ÷ 10 = 0.25)
100	Two places to the left (eg. 2.5 ÷ 100 = 0.025)
1000	Three places to the left (eg. 46.0 ÷ 1000 = 0.046)

1.2.3 Clinical Application

Penicillin is still sometimes ordered as:

- 1 x 10^6 units or 2 x 10^6 units
- 1 million units or 2 million units
- 1 mega unit or 2 mega units
- equivalent to 600 mg or 1200 mg

Insulin is always ordered in units and is always provided by the manufacturer as 100 units per 1 ml.

1.3 Drug Prescription

One of the risk factors identified in medication errors is the nurse's misinterpretation of a medical officer's order, either from a written prescription or a verbal/telephone order.

A medical officer's written prescription must be on an individual medication chart and written in ink. In writing the prescription the medical officer is obliged to follow rules laid down by the NSW Health Department that will make the directions clear to the nurse who is to administer, or the pharmacist who is to dispense, the medication. These rules are outlined in the policy on the handling of Medications in New South Wales Public Hospitals, NSW Department of Health Policy Directive PD 2005_206.

There are specific guidelines also in place for the management of Emergency Telephone orders and the use of Nurse Initiated Medications.

While medical officers prescribe medications, nurses are responsible for evaluating the prescription for appropriateness, preparing and administering the drug and monitoring for effect (Gahort & Nazareno, 2007).

1.4 Activity

a) List what information medical officers must include on each medication order:

b) List the responsibilities of the administering nurse:

c) What are Nurse Initiated Medications

d) Outline the process that should be followed when taking an Emergency Telephone Order

Assessment

a. Which of the following drug dosages would you query as being excessive for adults.

i *Phenytoin sodium* 300 mg every hour
ii *Ibuprofen 400mg 4th hourly*
iii *Pantoprazole 40mg TDS*
iv *Metoclopramide* 20mg TDS
v *amlodipine 10mg mane*

b. When should the following oral drugs be given in relation to food/meals?

i V*enlafaxine*
ii *Flucloxacillin*
iii *Amoxycillin and clavulanic acid*
iv *Captopril*
v Mixtard 30/70 insulin
vi *Doxycycline*
vii *Oxycodone*

1.5 Calculation of Drug Dosages

A prescription is usually a communication between a medical officer and a pharmacist. However, in hospitals the nurse is often the person who must interpret the prescription and follow the instructions regarding the identification of the drug, the dosage and the time of administration.

It is common practice that a pharmacist dispenses the drug(s) for a particular patient in a container that is labelled with the patient's name and the strength of the drug. However, in some situations the nurse may need to administer the drug from stock supplies.

In either case, the available strength of the drug may not be the same as the drug prescription. Therefore, it is vital that nurses are able to calculate how much of the drug to give. Tablets should only be split if absolutely necessary, such as when lower dose tablets are not available.

1.5.1 Calculating the Correct Dose

As you know, the formula for calculating drug dosages is:

Note: In calculating the correct dose:

- ensure that the dose required and the available strength are in the same units, ie. If the strength required is in milligrams and the available strength is in micrograms, then the milligrams should be converted to micrograms.

- the answer will always be a *volume* – either a number of tablets or millilitres in liquid.

$$\frac{\text{dose required}}{\text{available strength}} \times \frac{\text{stock volume}}{1} = \text{volume of stock to be given}$$

A patient is ordered 250 mg of antibiotic syrup. The bottle contains 500 mg in each 5 ml.

Please answer the following:

$$\frac{\text{dose required}}{\text{available strength}} \times \frac{\text{stock volume}}{1} = \text{volume of stock to be given}$$

$$\frac{250 \text{ mg}}{500 \text{ mg}} \times \frac{5}{1} = \frac{5}{2} =$$

A. Assessment

a The order is for *sertraline hydrochloride* 75mg. Available strength is 50 mg per tablet. How many tablets will you give?

b The order is for *frusemide* 40 mg. Available strength is 20 mg per tablet. How many tablets will you give?

c The order is for *metoprolol* 12.5 mg. Available strength is 50mg per tablet. How many tablets will you give?

d The order is for *digoxin* 0.125 mg. Available strength is 250 micrograms per tablet. How many tablets will you give?

e The order is for *selegiline hydrochloride* 10 mg. Available strength is 5 mg per tablet. How many tablets will you give?

f The order is for *aspirin* 150 mg. Available strength is 0.3 g per tablet. How many tablets will you give?

g The order is for *captopril* 6.25 mg. Available strength is 25 mg per tablet. How many tablets will you give?

B. Assessment

a The order is for *morphine* 15 mg. Available strength is 20 mg per 2 ml ampoule. How much will you give?

b The order is for 80 units of Protaphane. Available strength is 100 units per 1 ml. How much will you give?

c The order is for *penicillin* 150 mg. Available strength is 600 mg per 10 ml vial. How much will you give?

d The order is for *amoxycillan* 100 mg. Available strength is 250 mg per 5 ml of syrup. How much will you give?

e The order is for *heparin* 5,000 units. Available strength is 25,000 units per 5 ml ampoule. How much will you give?

1.6 Body Weight Calculations for Oral Medications

Drug dosages are usually calculated on milligrams per kilogram of body weight. This section will show you how to calculate doses based on body weight for oral medications.

1.6.1 Calculating Drug Doses for Body Weight

To calculate the dose of a drug for body weight you need to use the following formula:

number of mg/kg x body weight (in kg) = dose (mgs)

The adult dose of gentamicin for people with normal renal function is calculated at 5 mg per kg given as a single daily dose or in two equal doses.

Please answer the following:

Calculate the dose of gentamicin to be given per day if the patient weighs 85 kg.

5 mg x 85 kg =

1.6.2 Assessment

Patient weighs 48 kg.

a Calculate the dose of *gentamicin* to be given per day.

2 SAFE IV DRUG ADMINISTRATION

The package is designed so that you can test yourself and then seek confirmation or further information from reference material. The material covered is not comprehensive, but requires you to seek information on a number of topics so that you will review the resources available to you and be able to use them when necessary.

While the section revises intravenous (IV) drip rate calculations, it includes drug recognition and tests. The barrel of an intravenous giving set delivers a fixed drop size. There is currently one type of barrel in use in adult areas at JHH; the standard giving set which delivers 20 drops per millilitre.

Note: There are other lines and burettes available which deliver 60 drops per millilitre. If you are ever unsure about the drop size of the line you are using - check the back of the line packaging where it will be clearly stated.

2.1 Criteria and Standards

When administering drugs intravenously the Nurse is expected to:

- Communicate with and respond appropriately to the patient.
- Demonstrate familiarity with relevant unit and departmental policies and procedures.
- Seek information on the drug prior to administration.
- Administer the drugs safely, using a checking procedure which prevents errors, and an aseptic technique.
- Know the desired effect of the drug being administered.
- Recognise signs and symptoms of an adverse effect and be able to respond promptly.
- Document all relevant information appropriately.

2.2 Activity

Please complete the following questions:

a. Are you familiar with unit, department and John Hunter Hospital policies and procedures relating to IV drug administration? What is the policy for:-

i. Changing an IV cannula (frequency).

_____

ii. How often do you change patient's IV giving sets?

_____

iii. When do you document the administration of a drug?

_____

b. Do you know where to find information about unfamiliar drugs? List the resources available to you when on duty.

_____

_____

_____

c. Drugs which are commonly administered intravenously include:

Morphine	Heparin	Lasix
Potassium Chloride	Antibiotics	

Test your familiarity with these drugs by filling in the following chart. Try doing it without using reference books first, then use the reference books to check your answers and to complete the chart if necessary.

Drug	**Modes of Administration/ Standard Dosage**	**Action of Drug**	**Signs and symptoms of adverse effect**
Potassium Chloride			
Heparin			
Lasix			
Morphine			
Gentamycin			

d. Define the following terms:

Stevens-Johnson Syndrome

Ototoxicity

Allergy

Anaphylaxis

Chemical phlebitis

Tissue infiltration / Extravasation

e. Do you know how to respond to anaphylactic shock?

f. Prioritise and describe the actions you would take if you suspected a patient was having an anaphylactic response.

g. The formula for calculating IV drip rates is:

$$\frac{\text{volume (in ml)}}{\text{time in minutes}} \times \frac{\text{drops (per ml)}}{1} = \text{number of drops per minute}$$

Administer one litre of Hartmann's solution over a 10 hour period using a standard giving set.
Please answer the following:

$$\frac{1000\text{ml}}{10\text{ hrs} \times 60\text{ mins}} \times \frac{20\text{ drops per ml}}{1} =$$

2.2.1 Assessment

Calculate the drops per minute (dpm) for each of the following IV fluid orders:

a The order is for 1 L of IV fluid over 10 hours using a standard giving set.

b The order is for 100 ml of IV fluid over 1 hour using a standard giving set.

c The order is for 0.5 L of IV fluid over 2 hours using a standard giving set.

d The order is for 0.3 L of IV fluid over 5 hours using a standard giving set.

e The order is for 1200 ml of IV fluid over 12 hours using a standard giving set.

f The order is for 750 ml of IV fluid over 6 hours using a standard giving set.

g The order is for 1.8 L of IV fluid over 24 hours using a standard giving set.

2.3 Applying Calculations to Infusion Pumps

Volumetric infusion pumps are commonly used in hospitals (eg. IMED, IVAC, Baxter Braun syringe pump, patient controlled analgesia pump). These pumps must be set to deliver ml per hour and not drops per minute.

In order to calculate ml per hour you need to use the following formula.

$$\frac{\text{volume to be infused (in ml)}}{\text{time (in hours)}} = \text{ml per hour}$$

What setting (ml per hour) on the infusion pump will you need if aminophylline 500 mg is added to 500 ml of IV 5% glucose and is to run over 12 hours?
Please answer the following:

$$\frac{\text{Volume to be infused (in ml)}}{\text{time (in hours)}} = \frac{500 \text{ ml}}{12 \text{ hrs}} =$$

Note: The important components for the calculation are the volume (in ml - not the dose of the drug) and the hours over which it is to be infused.

2.3.1 Assessment

a. The order is for IV morphine 50 mg in 500 ml 5% glucose over 12 hours using a Baxter infusion pump. How many ml per hour will you set the pump to deliver?

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b. The order is for IV heparin 25 000 units in 50 ml normal saline over 12 hours using a Braun syringe pump. How many ml per hour will you set the pump to deliver?

Heparin is available on your ward as:
- 5000 units in 0.2 ml (for subcutaneous injection)
- 5000 units in 5 ml
- 25 000 units in 5 ml

c. The order is for heparin 17 500 units IV and you use ampoules that contain 5000 units per 5 ml. How much will you give?

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d. The order is for heparin 12 500 units in 100 ml normal saline over 12 hours using an Baxter infusion pump. How many ml per hour will you set the pump to deliver?

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e. The order is for heparin 12 500 units in 100 ml normal saline over 8 hours using an Baxter infusion pump. How many ml per hour will you set the pump to deliver?

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f. A patient is receiving IV 4% glucose and 0.18% normal saline via an infusion pump at 50 ml per hour. There is an in-line burette on the giving set and you need to give an antibiotic diluted in 70 ml over 30 minutes. How many ml per hour will you set the pump to deliver in order to administer the antibiotic over the prescribed time?

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g. The order is for gentamicin 80 mg in 100 ml normal saline over 30 minutes using an infusion pump. How many ml per hour will you set the pump to deliver?

2.4 Body Weight Calculations for Intravenous Flow Rates

Drug dosages are usually calculated on milligrams per kilogram of body weight. This section will show you how to calculate doses based on body weight for intravenous medications.

2.4.1 Calculating IV Flow Rates for Drug Doses for Body Weight

To calculate the flow rate for administering IV drugs, there are several steps you need to follow:

Step 1 number of mg/kg x body weight = dose (in mg)

Step 2 $\frac{\text{total mg to be loaded into IV fluid}}{\text{volume (in ml of IV fluid)}}$ = Dose of drug/ml

Step 3 $\frac{\text{dose in mg (as calculated in Step 1)}}{\text{amount of drug/ml (As calculated in Step 2)}}$ = flow rate

A patient weighing 71 kg is to receive aminophylline 500 mg that has been added to 500 ml of IV 5% glucose and infused at a rate of 0.5 mg/kg/hr. Calculate the flow rate in ml/hr.

Please answer the following:

Step 1 number of mg/kg x body weight = dose (in mg)

0.5mg/kg x 71 kg =

Step 2 $\frac{\text{total mg to be loaded into IV fluid}}{\text{volume (in ml of IV fluid)}}$ = Dose of drug/ml

$\frac{\text{500 mg (aminophylline)}}{\text{500 ml (5\% glucose)}}$ =

Step 3 dose in mg (as calculated in Step 1) = flow rate
amount of drug/ml
(As calculated in Step 2)

35.5 mg =
1 mg

2.4.2 Assessment

a. A patient weighs 85 kg. IV aminophylline 500 mg is added to 500 ml IV 5% glucose. The aminophylline infusion is to run at 0.5 mg/kg/hr.

   i. How many mg per hour will you administer?

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   ii. How many ml per hour will you set the infusion pump to deliver in order to administer the aminophylline?

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b. A patient weighs 60 kg. IV aminophylline 500 mg is added to 100 ml IV 5% glucose. The aminophylline infusion is to run at 0.5 mg/kg/hr. How many ml per hour will you set the infusion pump to deliver?

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3 CLINICAL SCENARIOS

SCENARIO A.

Your patient is charted IV *metronidazole* 500mg TDS 8, 16, 24. When you go into their room to hang their 8am dose, you find that they have been taken to Radiology. Your patient returns to the ward at 10am. What do you do about the 8am dose of *metronidazole*?

Your patient has an order for 500mg *colchicine* mane. When you take the drug out of the trolley, you notice that the *colchicine* strength is 500mcg. What would you do?

SCENARIO B.

Working a night shift, you have commenced your newly admitted patient, a mildly disorientated elderly man with deep venous thrombosis, on an IV Heparin infusion. The infusion is running at 2.0 ml/hour via a Braun syringe pump. On returning to do a ward round just over an hour later, you notice that the IV Heparin infusion is now running at 90.0 ml/hour and the syringe is $^{2}/_{3}$ empty. What do you do? Could anything have been done to prevent this from occurring?

SCENARIO C.

Mr Brown has been admitted with pneumonia and is being treated with IV antibiotics. He has a history of a motor vehicle accident two years ago and a subsequent back injury. While assisting Mr Brown to the shower, he asks you to collect his soap from his locker draw. When you pick up the soap you notice a half-empty card of Panadeine Forte. He states that he has had to take them for his back pain as the Doctor will not chart them regularly enough for him - he has been taking them as often as 2/24 at home. What are the legal issues with patients self-medicating while an inpatient in an acute hospital? What is the acceptable dose and frequency of Panadeine Forte for an adult? What would you do about the Panadeine Forte in Mr Brown's draw?

SCENARIO D.

Mrs Jones 65 years of age, had a right total hip replacement yesterday. She is prescribed *cephalothin* sodium 1g IV as a bolus dose 6th hourly. At 0600hr hours you give cephazolin sodium 1g IV - you recognise your error immediately after administering the drug. List your actions, in order of priority. Discuss how you could have avoided making this error.

SCENARIO E.

Working a busy afternoon shift, you are expecting a new patient from the Emergency Department. Mr Green has been admitted with congestive cardiac failure requiring treatment with IV Dopamine. You are tending to another patient when Mr Green arrives on the ward. The emergency nurse pops her head around the corner and tells you that Mr Green is 'ok' and has his buzzer. When you have the other patient settled, around 15 minutes later, you go to take Mr Green's vital signs. When you reach the bedside you notice that the Baxter pump that the infusion should be running through has been removed and that the clamp on the IV line has not been clamped. What do you do immediately? What is Dopamine and what is it used for? Are there any special precautions that should be taken when administering Dopamine?

SCENARIO F.

On a morning shift, during your 8 am pill round, you administer 70mg units of subcutaneous Clexane to Mrs White. While doing your 12 midday round, you notice that Mrs White has both 70mg Clexane bd and 70mg Enoxaparin bd charted. She received doses at 8 am - given by you and a dose at 6 am - given by the night staff. What would you do? What are possible effects from over administration of Clexane? Explain the administration technique for Clexane.

4 SUGGESTED MEDICATION READING AND REFERENCE LIST

Gahort, B. L. and Nazareno, A. R. (2007). Intravenous Medications. A Handbook for Nurses & Health Professionals (23rd edition). Missouri Mosby Elsevier.

Mayo, A. M. and Duncan, D. (2004). Nurses perceptions of Medication Errors: What we Need to Know for Patient Safety. Journal of Nursing Care Quality. 19(3), 209-217.

McIlwraith, J and Madden, B. (2006). Drugs in Health Core and the Law (3rd edition). Sydney: The Law Book Company.