# HAVARD'S NURSING GUIDE TO DRUGS

11TH EDITION

ADRIANA TIZIANI

ELSEVIER

# FORMULAE FOR CALCULATIONS OF DRUG DOSES AND DRIP RATES

## Oral Drugs (Solids, Liquids)

$$\text{Amount required} = \frac{\text{Strength required} \times \text{Volume of stock strength}}{\text{Stock strength}}$$

## Parenteral Drugs

### Solutions (IM, IV injections)

$$\text{Volume required} = \frac{\text{Strength required} \times \text{Volume of stock strength}}{\text{Stock strength}}$$

### Powders

It is essential to follow the manufacturer's directions for dilution and then use the appropriate formula.

### IV infusions

$$\text{Rate (drops/min)} = \frac{\text{Volume of solution (mL)} \times \text{Number of drops/mL}}{\text{Time (min)}}$$

Example: a drip chamber that delivers 20 drops/mL is to be used to administer 1 L (1000 mL) of solution over 2 hours

$$\text{Rate} = \frac{1000\ \text{mL} \times 20}{120} = 167\ \text{drops/min}$$

$$\text{Rate (mL/h)} = \frac{\text{Drug dosage rate (mg/h)} \times \text{Volume of solution (mL)}}{\text{Total amount of drug (mg)}}$$

### Infusion pumps

$$\text{Rate (mL/h)} = \frac{\text{Volume of solution (mL)}}{\text{Time (h)}}$$

$$\text{Rate (mL/min)} = \frac{\text{Volume of solution (mL)} \times 60}{\text{Time (min)}}$$

***Note:*** **After selecting the appropriate formula, ensure that ALL strengths are in the SAME units and convert if not.**

## Other Useful Formulae

### Children's dose (Clarke's body weight rule)

$$\text{Child's dose} = \frac{\text{Adult dose} \times \text{Weight of child (kg)}}{\text{Average adult weight (70 kg)}}$$

### Children's dose (Clarke's body surface area rule)

$$\text{Child's dose} = \frac{\text{Adult dose} \times \text{Surface area of child } (m^2)}{\text{Average adult surface area } (1.7\ m^2)}$$

***See inside back cover for useful units and concentrations, and common abbreviations.***

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To all my 'boys'.
You are the 'wind beneath my wings'.
Thank you for your love and support through this difficult journey.
Love you

**AT**

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# CONTENTS BY BODY SYSTEM

## Cardiac and Vascular Systems



## Central Nervous System



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## Respiratory System



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## Infection and Infestations



## Miscellaneous

# INTRODUCTION

As with the original aim of the book, *Havard's Nursing Guide to Drugs* continues to be a guide only. This book is meant to be a companion guide to pharmacology texts, something smaller and easier to transport around and reference in the clinical setting, given its availability as an eBook as well.

## The Nurse's Role in Drug Therapy

The aims of administering medication are to do it in a safe and efficient manner while observing the patient for both desirable and undesirable effects. Therefore, the nurse needs to:

- assess the patient, including medication history
- have an understanding of the legal requirements associated with the administration of drugs
- have pharmacological knowledge of the medication(s)
- be able to safely administer medications.

## Assessing the Patient

Patient assessment should be holistic, looking at the patient's condition and personal circumstances as an entirety, rather than simply as a disease to be treated. It should include:

- all current medical problems
- co-morbidities
- relevant past history
- physical assessment
- medication history (including current medications, over-the-counter (OTC) preparations, herbal preparations, vitamin and mineral supplements)
- alcohol or tobacco use (and in some cases, illicit drug use).

Medical history, co-morbidities and medication history are intertwined, as a person with co-morbidities is often prescribed multiple medications concurrently (polypharmacy), which increases the risk of adverse effects and interactions. Sometimes a person sees more than one medical practitioner (e.g. general practitioner (GP) plus specialist/s), which increases the risk of medications not being regularly reviewed.

People may become confused because medications can have more than one brand/trade name for the same generic drug and they can potentially end up taking the same drug twice (e.g. a patient taking Urex and Lasix (both trade names for furosemide (frusemide)) may become quickly dehydrated).

Unfortunately, people do not always complete courses of medications, especially antibiotics, and 'keep the rest for next time' with no understanding of the ramifications of doing this (e.g. bacteria becoming resistant to that antibiotic and the agent becoming ineffective in treating that same infection if it recurs). Other reasons for not completing courses of medications (or getting prescriptions refilled) include adverse effects, costs or failing to see any obvious benefits from the medication.

Some people believe they are allergic to medications. It is important for the nurse to explore what form the allergy takes (e.g. someone may mistakenly believe that they are allergic to morphine because they were nauseous and vomited after taking it (a common side-effect), whereas another patient may correctly describe an anaphylactic reaction with

breathing difficulties after administration of an antibiotic).

Many people take OTC preparations or alternative medicines, including herbal preparations, either concurrently or instead of traditional medication. OTC preparations are those that are non-prescription and are generally intended for short-term use only in self-limiting illnesses, such as headache, heartburn and constipation. OTCs also include vitamins, minerals, herbal drugs and remedies (e.g. St John's wort, ginseng), and unfortunately many people consider them to be 'safe' because they are natural. However, many herbal drugs and remedies interact with prescription medications (e.g. St John's wort interacts with warfarin, increasing its metabolism and decreasing its effectiveness); antacids can interfere with some oral medications if not taken 2 hours apart; and non-prescription medications such as aspirin and ibuprofen can cause gastrointestinal bleeding and must only be taken at recommended doses. OTCs are readily available in pharmacies and supermarkets, with the buyer not needing to seek advice before purchasing these products.

It is essential for the nurse to establish if the patient is compliant/adherent/concordant with his or her medication regimen, and if not, why not. While these terms are sometimes used interchangeably, there are some important differences between them. *Compliance* suggests that the patient has little input into their management strategy and follows doctor's orders (power lies with the doctor), while *concordance* is at the other end of the spectrum, and is based on equality and respect between the patient and the healthcare practitioner. *Adherence* falls somewhere in between as there is negotiation between the patient and the healthcare professional that is based around the therapy. Intentional non-adherence describes a patient deciding to reject their treatment, which may seem rational from their perspective, although the clinician may not agree (Anderson 2013).

Adherence is a very complex issue. Some of the factors that may lead to a patient being non-adherent with a medication regimen may include:

- multiple medications required
- complex dosing schedules (a person is more likely to remember a once-daily dosing schedule, compared to a 3–4 times daily regimen)
- the medication is difficult to take or administer (e.g. medications that have an unpleasant taste or are large in size; eye and ear drops that are difficult to instil)
- impairments, including:
  - sight (e.g. unable to read directions)
  - dexterity (e.g. arthritis) may make it difficult to open containers with childproof lids or blister packs
  - memory (e.g. unable to remember instructions of how or when to take medication)
- adverse effects (i.e. the person may decide that the side-effects of the medications are worse than the disease itself)
- feeling 'better' and therefore not needing to take the medication any longer
- not 'seeing' any effects from the medication (e.g. effects of lipid-lowering agents are not visible and these are commonly discontinued by patients)
- the cost and ease of filling prescriptions (e.g. decreased mobility or lack

of transport to be able to get to the pharmacy)
- lack of knowledge/understanding of the disease process and the role of medication in disease management
- language, cultural and/or religious issues
- attitude towards medication, disease and/or health (e.g. a 'devil may care' attitude or thoughts such as 'I have to die of something')
- inconsistency in the messages that healthcare providers are giving (e.g. one nurse advises the patient to take certain medications 30–60 minutes before food, while another nurse says that it doesn't matter when the medication is taken). Not only are these inconsistent messages confusing for the patient, but they damage the trust the patient may have in the nurse(s), as well as potentially affecting the absorption and effectiveness of the medication.

Armed with all this information, the nurse is in an ideal position to support and educate the patient (see section on General Patient teaching and advice, p. xxvii).

## Children and the Elderly

Children and the elderly require highly specialised nursing care and knowledge regarding the administration of medications. Special care should be taken with dosages because an overdose can occur easily due to smaller weights (and surface ratios), and differences in kidney and liver capacity. There are many specialised texts available that cover both these groups in detail and take into account the differences in drug administration. Specific paediatric and geriatric dosages are not generally included in this book. Doses are for the 'average' adult patient. The only exceptions are when a particular drug is mainly or specifically used in paediatrics (e.g. drugs used for attention deficit disorder, growth hormone).

Many older people require assistance with the administration of medications and the nurse may consider splitting or crushing tablets in order to make them easier to take. Before doing this, investigate whether the medication is available in a different oral form (e.g. liquid rather than solid) or a non-oral form (e.g. dermal, rectal, intranasal). Tablets with an enteric coating should not be crushed as these are formulated to ensure the medication passes through the stomach intact (e.g. enteric aspirin is formulated to prevent gastric irritation). Extended-release medications (often marked as CD, CR, SA, SR) are designed to release the active components over an extended period and therefore should not be crushed. Further discussion on crushing or dispersing medication for easier administration can be found on p. xxi.

## Drugs in Sport

The World Anti-Doping Agency (WADA) was established in 1999 to foster a doping-free culture in sport by:
- conducting scientific research to develop new detection methods
- educating athletes and support personnel
- raising awareness and providing information about doping and its consequences
- conducting an unannounced out-of-competition testing program that complements the programs of the International Sports Federations
- developing an independent observer program (which randomly monitors

and reports on all phases of doping control in an unbiased manner)
- monitoring acceptance and compliance with the World Anti-Doping Code, which ensures all athletes in all sports are governed by the same anti-doping rules and regulations.

WADA classifies drugs or methods into those that are prohibited at all times and those that may be prohibited in-competition and out-of-competition in some sports. Prohibited at all times include:
- anabolic steroids (e.g. stanozolol, testosterone)
- peptide hormones (e.g. erythropoietin), growth factors and related substances (e.g. growth hormone)
- beta-2 agonists (e.g. formoterol, NOT inhaled salbutamol or salmeterol)
- hormone antagonists and modulators (e.g. clomiphene, aminoglutethimide, tamoxifen)
- diuretics (e.g. furosemide (frusemide), acetazolamide) and other masking agents (e.g. probenecid)
- manipulation of blood and blood components, including substances that enhance oxygen transfer (e.g. haemoglobin products), blood doping (e.g. red blood cell product of any origin) and sample manipulation methods (e.g. tampering with samples or urine substitution)
- gene or cell doping (e.g. use of genetically modified cells)
- narcotics (opioids) (e.g. heroin, morphine, fentanyl) and cannabinoids (e.g. marijuana)
- glucocorticosteroids (oral, IV, IM or rectal) (e.g. dexamethasone, prednisolone) (WADA 2020).

Prohibited in-competition are stimulants (e.g. amphetamines, epinephrine (adrenaline), pseudoephedrine), while prohibited in-competition and out-of-competition in some sports only (e.g. archery, shooting) includes the beta2 adrenoceptor blocking agents (e.g. propranolol) (WADA 2020).

It is imperative that athletes (and the athlete's team) are aware of substances and methods that are prohibited at all times, substances that are prohibited in-competition and substances that are prohibited in particular sports. Important also is the need to know when and how to apply for a therapeutic use exemption (TUE), as well as understanding that sport supplements are largely unregulated and hence may contain substances prohibited by WADA (WADA 2020).

## Pregnancy

Any medication (including OTCs, herbal preparations, alternative therapies or chemicals such as alcohol) has the potential to reach the developing fetus via the maternal circulation if taken during pregnancy. The risk to the fetus is dependent on a number of factors, including fetal gestational age on exposure (i.e. the fetus is most at risk during the first trimester when cells are rapidly proliferating and organs, muscles, CNS, arms, legs, toes and fingers are developing), duration of therapy (including dose, frequency and length of therapy), as well as any other medication taken concurrently (Bryant et al 2019). Animal studies have shown considerable differences in species' response with regard to the teratogenic effects of drugs and it may not be possible to extrapolate this data to humans. Fetal abnormalities include missing digits, excessive development or duplication of parts, splitting of parts abnormally, non-splitting of parts, fusion failure or

over-fusion of some parts, openings failing to close or open adequately or abnormal placement of parts.

If possible, medications should be avoided during pregnancy. However, this is not always possible or practicable. The woman who is pregnant (or considering pregnancy) should work in partnership with her medical practitioner to develop a medication regimen that balances the benefits to the mother against the potential risks to the fetus. For example, a woman with epilepsy may need to consider the potentially life-threatening risks associated with uncontrolled epilepsy versus the benefits of controlling epilepsy with an agent that has an increased risk of causing fetal abnormalities.

## Breastfeeding

Most drugs taken by a mother who is breastfeeding will be excreted to some extent in the breastmilk; however, the amount ingested by the infant will generally be extremely small, dependent on the age of the infant and the amount of breastmilk consumed (Hotham & Hotham 2015). Some drugs are concentrated in breastmilk relative to the maternal plasma concentration because of their chemical properties, including fat solubility, and may be toxic to the infant because of immaturity of the liver and kidney detoxification systems. Drugs contraindicated during breastfeeding include amiodarone, antineoplastic agents, gold salts, iodine, lithium, oral retinoids and radiopharmaceuticals. Further contraindications during breastfeeding include those very toxic agents where even very small amounts will affect the infant, if the drug has highly allergenic potential, if the maternal renal function is compromised (as this may lead to higher levels being excreted into breastmilk or the mother having a medical condition requiring prolonged administration of a drug (e.g. cancer) (Bryant et al 2019; Hotham & Hotham 2015).

Administering the drug when or immediately after the infant feeds will result in the lowest amount of drug being in the milk at subsequent feedings. If a drug is essential for the mother but of uncertain effect on the infant, it may be necessary to temporarily discontinue breastfeeding and remove contaminated breastmilk (via breast pump), which should be discarded (Bryant et al 2019).

If medication is taken during breastfeeding, the infant should always be closely observed for any side-effects, including poor feeding, listlessness, withdrawal symptoms and other abnormal behaviours, which should be reported if they occur.

## Renal and Liver Impairment

Dose reduction is often required in those with any type of kidney and/or liver impairment because these organs are the main sites of drug metabolism and excretion. Monitoring of kidney and liver function throughout any drug therapy may be recommended to ensure that there is no further deterioration caused by the therapy. Furthermore, some medications may damage the liver or kidneys (e.g. large doses of paracetamol are hepatotoxic, NSAIDs may be nephrotoxic). If potentially nephrotoxic or hepatotoxic agents are given to those with renal or liver impairment, the risk of further damage is greatly increased.

## Legal Requirements

Before a drug can be administered safely, the nurse needs to be aware of the legal

aspects of drug administration. This includes knowledge of the laws governing the possession, use and dispensation of drugs and of the directives of the nurse's registering body on the administration of medications to clients. It also means observing the employing healthcare facility's occupational health and safety (OHS) regulations which are designed to promote safe storage, handling and use of drugs.

The Nursing and Midwifery Board of Australia (NMBA) is one of the national boards of the Australian Health Practitioner Regulation Agency (AHPRA). With the changes to registration of nurses by AHPRA from 2010, it was decided that enrolled nurses no longer required endorsement for medication administration. The NMBA's goal is for all enrolled nurses to undertake relevant units of study that will enable them to administer medicines safely as part of their education program. However, for enrolled nurses who have not completed the required units, a notation reading 'Does not hold Board-approved qualifications in administration of medicines' will appear on the national nursing register against that nurse's name (NMBA AHPRA 2020b). Jurisdictional legislation and policy specifies the routes and schedules of medicines that the enrolled nurse is able to administer and it is therefore of paramount importance that the nurse and employer understand and comply with the drugs and poisons legislation and policy. Furthermore, to administer intravenous medication, the enrolled nurse (Division 2) is required to have completed a separate NMBA-approved unit on the administration and monitoring of intravenous medications (NMBA AHPRA 2020b).

Legal Acts concerning poisons and the poisons regulatory bodies in New Zealand and each state and territory in Australia deal with the control of all drugs, from prescription medication through to agricultural poisons and research drugs. The Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) applies to sale, supply, containers, disposal, record keeping, storage, labelling, possession, use and advertising. The drugs and poisons contained in the schedules are divided into groups according to their mode of action, therapeutic use, potency, potential for abuse and addiction and safety. In Australia, there are currently 10 schedules with most medications being listed in Schedules 2, 3, 4 or 8 (Therapeutic Goods Administration 2020). Unscheduled substances (i.e. those not contained in these 10 schedules) are not considered a poison by definition and can be supplied to the public; these include laxatives, sunscreens, baby formula, herbal remedies and vitamins (Bryant et al 2019).

While medical practitioners are the main health professionals that advise and prescribe medications, there are members of other health disciplines who have limited prescribing rights. Nurse practitioners, as defined by the *Nurses Act 1993*, are those whose registration has been endorsed as being qualified to obtain and have in their possession and to use, sell or supply Schedule 2, 3, 4 or 8 poisons, as described under the *Drugs, Poisons and Controlled Substances Act 1981* (Version No. 065, 1/12/2003). The approved list of medications (scheduled poisons) is dependent on nurse practitioners' scope of practice (e.g. an acute care nurse practitioner list will be different to that of a paediatric care nurse practitioner). Dentists are able to

prescribe drugs related to their practice (e.g. antibiotics, analgesics); podiatrists with endorsement may prescribe a limited range of Schedule 4 drugs related to podiatry practice (e.g. antibiotics, analgesics); optometrists (in some states, with extra training) are also able to prescribe a limited range of optometry-related Schedule 4 drugs (e.g. eye drops, drugs to treat glaucoma); midwives (with endorsement for scheduled medicines) are qualified to prescribe medications related to midwifery practice (Bryant et al 2019; NMBA AHPRA 2020a).

## Storage

All medications in a ward or department should be kept in a locked cupboard, medication trolley or some other type of locked container, the key of which is kept by a nurse at all times. Victoria's Drugs, Poisons and Controlled Substances Regulations 2017 are very specific about the storage requirements for Schedule 8 or Schedule 9 poisons (e.g. constructed of steel 10 millimetres thick; fitted with a 6 lever lock; able to resist attack by hand tools for 30 minutes or power tools for 5 minutes) (Victorian Government 2017), with other states having similar requirements.

Drugs or preparations for external use should be stored apart from those intended for internal use, so that errors in administration do not occur. Suppositories, pessaries, insulins, antisera, vaccines, some blood products, some intravenous solutions and some antibiotics (particularly if reconstituted) should be stored in the refrigerator. Nothing else should be stored in the refrigerator (e.g. food) and it should also be kept locked.

The trend towards single-dose units being dispensed contributes to accuracy in dosage, better economy and less risk of product contamination. Many institutions have policies that discourage the use of multi-dose vials because of the risk of cross-contamination between patients.

## Drug Orders

In 2004 Australian health ministers advised that 'to reduce the harm to patients from medication errors, by June 2006, all public hospitals will be using a common medication chart. This means that the same chart will be used wherever a doctor or nurse works and wherever the patient is within a hospital' (ACSQHC 2019a). The result was the National Inpatient Medication Chart (NIMC). Since then, additional national charts have been developed, including the National Residential Medication Chart (NRMC), National Subcutaneous Insulin Chart, Paediatric National Inpatient Medication Chart, Clozapine Titration Chart, NIMC (acute), NIMC (long stay), NIMC (day surgery) and NIMC (day surgery, private hospital) (ACSQHC 2019b).

A drug or preparation may be given only on written or verbal order from a medical officer, and must be clearly written and/or understood verbally. The law in all states requires that a legal drug order must be legibly written in ink, dated and signed by the prescriber and must include the patient's name and identification number (if applicable), the name and strength of the drug, the dose, route of administration, frequency of administration and duration of administration (if applicable). Any alteration to a drug order should be initialled. An unusual dose, drug strength or quantity should be underlined and initialled by the prescriber. If there is any doubt about the meaning of the order, the medical

officer should be contacted immediately for clarification before administration.

The policy of the institution should be consulted before taking telephone orders for drugs. A telephone order should only be taken 'if in the opinion of the registered medical practitioner, dentist or nurse practitioner, an emergency exists' (Drugs, Poisons and Controlled Substances Regulations 2006, Reg. 47, 2 (C)). Errors may be eliminated if the nurse ensures that the drug has been ordered for the correct patient, writes it on the correct patient's medication chart, then asks a second nurse to read the drug order back over the telephone to the medical officer. The order should be confirmed in writing by the prescriber as soon 'as practicable'. However, institutions may have their own policies that require their medical officers to sign the order within 24 hours. If any doubt at all exists (e.g. the patient is unwell and requires reviewing, the nurse is unsure about the drug, dose etc.), the nurse should not take the telephone order and should ask the medical officer to review the patient or medication order as soon as practicable.

## Legal Responsibility

Following a medical officer's order was once thought by many to absolve the nurse from all responsibility. However, legal judgements have shown that this is not always the case. The question that is often asked in situations of a drug error occurring is, 'What would the *reasonable* nurse do in this situation?'

Given that administering drugs is an everyday part of the role of most nurses, it is therefore not an unfair expectation that they will have some knowledge of the drugs they are administering. This includes the class of drug, why it is prescribed (purpose), how it works (action), recommended or usual dose range, how it is administered, contraindications, side-effects, potential for causing allergic reactions, any interactions with foods or other drugs and compatibility (especially when multiple intravenous drugs are to be administered).

It is not necessary for the nurse to memorise all this information; however, what is important is that the nurse has ready access to information and knows where or how to readily do so *before* administration. Information on any drug or preparation may be obtained from a pharmacist, textbooks or *reliable* internet sources. Once in possession of this knowledge, the nurse can question an unclear order, assess what skills are required to carry out the order and will understand what to observe in the patient in terms of beneficial and adverse effects.

## Drug Incidents (Errors)

Drug incidents (or errors) are any preventable events involving medications that may result in harm and are related to the prescribing, dispensing or administering stages of the process (Jokanovic et al 2019). An audit of inpatient medication charts found that about 56% of errors were prescribing errors, 6% transcribing errors, 4% dispensing errors and 34% were administration errors (Atik 2012). Drug errors can cause adverse effects in patients, including death, as well as adding costs to the healthcare budget. A 2002 study by the Australian Commission on Safety and Quality in Health Care (ACSQHC), before the introduction of the National Inpatient Medication Chart, found that drug therapy errors occurred in 5–20% of drug administrations within

Australia, with a later 2006 study by ACSQHC finding that more than 700,000 hospital admissions each year were related to medication adverse effects, resulting in about $350 million in costs, and more importantly, 8000 deaths (ACSQHC 2019).

Administration incidents (errors) occur when:

- the wrong drug is administered, including the administration of the wrong intravenous fluid (e.g. drugs with similar names; use of abbreviations for names)
- the wrong dose is given (e.g. misreading dosage or units; misinterpreting abbreviations used for units, such as micrograms)
- the drug is given via the wrong route (e.g. an oral drug given intravenously)
- the drug is given to the wrong patient
- the drug is given at the wrong time or frequency, including omission, and/or
- an intravenous infusion is administered at the wrong rate.

Since 2008, standard prescribing terminology, abbreviations and symbols have been introduced in an attempt to reduce the number of associated errors. Abbreviations are used when referring to strength of medications, such as grams (g) and milligrams (mg). For example, the abbreviation for micrograms using the Greek letter μ (mu), that is, μg, is not recommended, nor is mcg, as these may lead to errors; microg is the preferred and recommended abbreviation, or the whole word (microgram) should be used. Other error-prone abbreviations and symbols that should be avoided include IU (international units – can be mistaken for IV), IVI (intravenous injection – mistaken for IV 1) and qd (every day – mistaken as qid (4 times daily)) (ACSQHC 2016a).

The use of 'dose administration aids' (DAAs), commonly found in the community and some residential aged care facilities, may not necessarily reduce the number of administration errors. A 2006 study found that DAAs contained a significant number of errors (incident rate 4.3% of packs and 12% of residents), which included missing medications, the wrong medication or wrong strength of medication dispensed, incorrect dosage instructions supplied or medications being supplied that had been ceased by a doctor (Carruthers et al 2008). A 2016 study by Gilmartin and colleagues also found similar results with a proportion of inspected DAAs having additional medications added to them, medications missing, incorrect or inappropriate division of tablets amongst identified errors. Furthermore, while the majority of errors were classified as minor or insignificant, there were also a number of potential major or catastrophic errors (Gilmartin et al 2016). Although on the surface this would appear to be a dispensing and pharmacy-related problem, it is also the responsibility of the nurse administering the medications to have some idea of what medication a patient has been prescribed (or no longer prescribed), and what the medication(s) actually looks like. DAAs are not suitable for all patients and require careful patient selection (e.g. the community-based patients should be motivated and willing to take the medication, have adequate vision, dexterity and cognition) and awareness of the limitations of the aid selected (e.g. increase in cost, including set-up costs; doses missed if medication spilled during administration and no back-up available;

if home delivered, no opportunity for pharmacist review and counselling; many medicines cannot be packed into a dosing aid; do not address intentional non-adherence, poor motivation or forgetfulness) (Elliott 2014).

An administration error may or may not have an adverse effect. The seriousness of the outcome (e.g. the adverse effect or lack of effect) does not absolve the nurse from the mistake that was made. It is important to clearly document the error and outcome. Some institutions may also have policies regarding further documentation requirements when an error has occurred (e.g. a 'drug incident' form).

It is important for nurses to practise within their own limitations and within the policies and protocols of the institution. If this is not done and an error occurs (especially a serious one), the nurse may find that the institution (and its insurers) may abrogate any responsibility because the nurse did not follow its policies. The nurse may also be liable under common law.

## A Little Pharmacology

For extensive pharmacokinetics and pharmacology, refer to pharmacology texts. Here are some basic concepts that nurses need to understand.

### Drug dosage

*Dosage* depends on the age, weight, sex, renal and liver function and general condition of the patient, and can be based on age, body weight or body surface area. As children usually require smaller doses than adults, various rules are used to estimate the fraction of the adult dose (see inside front cover).

*Dose interval* is important (e.g. anti-infective agents are given at regular intervals, 4-, 6- or 8-hourly, to maintain adequate blood levels, while hormones are given at the same time each day for uniform effect). The time of day must be suitable to the individual's lifestyle. For example, diuretics may be ordered twice daily and normal convention would see them administered at regular intervals (e.g. 8–10-hourly during the day); however, for an older person it may be more practicable to administer the diuretic in the morning and at lunchtime, so that sleep is not disturbed by frequent micturition, increasing the risk of falls.

### Drug half-life

The half-life of a drug is a function of both distribution and elimination. In general terms, it is the time required for one-half of the amount of drug in the body to be eliminated. It is of practical use in calculating the frequency with which multiple doses of a drug can be administered to keep the blood level between the minimum effective concentration and the threshold for toxicity (e.g. a drug with a very short half-life may need to be administered intravenously to maintain levels, while another drug with a long half-life may be suitable for once-daily administration). Furthermore, a drug with a very long half-life may require patient monitoring for some time after the drug has been discontinued, or may require a 'washout' period to allow the drug to be removed from the system before the introduction of another agent.

### Therapeutic drug monitoring

Some drugs have a narrow therapeutic range (i.e. the difference between overdosing and underdosing). Therapeutic drug monitoring involves measuring drug concentration in the blood. Information

accompanying a request form should include the time the blood sample was taken, the time the last dose of the drug was given and its route of administration. The main aim of therapeutic drug monitoring is to optimise drug therapy by achieving adequate drug levels while minimising toxicity. It is especially important in those at the extremes of age (i.e. babies and the elderly).

## Why measure drug levels?

Drug levels are measured for a number of reasons, which include:

- to individualise the dose (e.g. lithium, phenytoin, warfarin, levothyroxine)
- to assess the adequacy of loading dose (e.g. phenytoin) or to check levels after dose adjustment
- to avoid or diagnose toxicity (e.g. digoxin, vancomycin)
- to ensure effective blood levels (e.g. prophylactic antiepileptics, gentamicin)
- to check adherence to regimen (e.g. antipsychotic agents)
- to check that co-morbidities that may alter drug metabolism and elimination (e.g. renal impairment, hepatic failure, shock, sepsis) are not affecting blood levels
- to ensure that concurrent drug administration is not affecting blood levels
- to diagnose sub-therapeutic or failed therapy (to distinguish between ineffective drug treatment, non-adherence and adverse effects that mimic underlying disease)
- to change the route of administration or dosage (e.g. from IV or IM to oral administration) if necessary while maintaining adequate serum levels
- to guide withdrawal of therapy (Bryant et al 2019).

## Drug route

The effectiveness of a drug often depends on the route of administration. A drug may have a systemic or local effect depending on whether it is taken orally, injected or applied topically (see Glossary, pp. 1657–58 for forms of preparations). Drugs are formulated to meet the requirements for rapid or slow absorption, metabolism or excretion in order to obtain the required therapeutic blood levels. The two most common routes of drug administration are oral and parenteral.

### Oral administration

Many oral preparations are given on an empty stomach because food may decrease the absorption; however, if gastric irritation is a problem they may be given with or immediately after food.

It is recommended that a capsule is preceded by a small amount of water and then taken with half a glass of water to prevent it becoming lodged in the oesophagus. A number of medications known to cause oesophageal ulceration include aspirin, bisphosphonates (e.g. alendronate), doxycycline, iron tablets, potassium chloride and zidovudine (Gowan & Roller 2010). Enteric-coated, slow-release, extended-release, modified-release, sustained-release and controlled-dosage tablets should be swallowed whole, not crushed or chewed, for a number of reasons, which may include:

- absorption will be altered (e.g. MS Contin, Keflor CD, Efexor XR, Dilantin)
- the medication may become unstable (e.g. Augmentin Duo, Nimotop)
- they may cause local irritation (e.g. Cartia, Roaccutane)

- they will not reach the site of the intended action (e.g. Creon, Dipentum)
- unacceptable taste (e.g. Neoral, Coloxyl)
- being hazardous (e.g. Imuran, Myleran, Leukeran).

Care must be taken to select the correct formulation of tablets when several different formulations and/or dosages exist (e.g. Isoptin (verapamil) is available in 40 mg, 80 mg, 120 mg or 160 mg tablets; Isoptin SR is available as 180 mg or 240 mg), because the consequences may be very serious if the wrong formulation is administered (e.g. substituting Isoptin 80 mg (3 tablets), which will act quickly compared with Isoptin SR 240 mg, which is a sustained-release preparation and will act over 24 hours). It is important to check whether different formulations are interchangeable or not (e.g. olapatib is available as a tablet or capsule. However, the strengths are different as are the recommended dosages and are therefore not interchangeable).

### Crushing or dispersing medications

It is important to check if the medication can be dispersed or crushed. As previously stated, sustained- or modified-release medications should not be crushed or dispersed. Important considerations include:

- assessing whether the patient has any swallowing difficulties or is 'at risk' of aspiration. If there are any concerns, referral to a speech pathologist is recommended to determine appropriate fluids or soft foods (e.g. apple puree, yoghurt) that can be used to administer crushed or dispersed medication
- checking if the medication is available in a different formulation which is easier to administer (e.g. syrup or solution rather than tablet form)
- only preparing one medication at a time (i.e. only one tablet should be crushed and prepared at a time, not the patient's entire medications)
- any fluid restriction when dispersing medication (e.g. how much fluid should be used to disperse the medication, which should be considered in the patient's overall fluid intake)
- using a closed tablet crusher for medications which are hazardous, cytotoxic or teratogenic
- use of safety glasses, mask and gloves for handling of medications which are hazardous, cytotoxic or teratogenic
- reducing pregnant staff contact with medications that are hazardous, cytotoxic or teratogenic
- ensuring mortar and pestle/tablet crusher are cleaned between medications and between patients (Society of Hospital Pharmacists of Australia 2018).

## Parenteral administration

Parenteral medications are given either as injections or by infusion. The most common routes are intramuscular (IM), subcutaneous (SC) and intravenous (IV).

### Intramuscular

The three main muscles used for intramuscular injections are:

- the lateral aspect of the thigh (middle third when the thigh is divided into three)
- the upper outer quadrant of the dorsogluteal
- the deltoid.

No more than 5 mL should be administered by intramuscular injection, and less into the deltoid muscle. If a volume $>$ 5 mL is required, the dose should be divided and given into different sites.

Furthermore, the deltoid muscle is not recommended for intramuscular injection in children.

### Subcutaneous

Subcutaneous injection sites include:

- upper outer aspect (middle third) of the upper arm
- upper anterior thigh
- abdomen below the costal margins to the iliac crests (avoiding the area around the navel by about 5 cm).

When frequent administration is required (e.g. insulin administration in a patient with diabetes mellitus, daily heparin injections), administration sites should be rotated and documented on the medication chart to prevent atrophy of the subcutaneous tissue, increased risk of infection and pain.

### Intravenous

A drug may be given by direct IV injection as a bolus in a volume of 20 mL or less in under 1 minute, or by slow IV injection over 5–15 minutes. It is important to check and adhere to the manufacturer's information regarding the required administration time, because administering some drugs too quickly can cause pain, damage the blood vessel, as well as other adverse effects, such as flushing, hyper- or hypotension, syncope, arrhythmias, feelings of warmth or anxiety, depending on the drug administered. IV injection (bolus or slow injection) is used when an immediate effect is required or the drug becomes unstable on reconstitution or dilution. The intermittent infusion method is used when a drug is diluted, when interval dosing is desired and when slow administration is required. The drug is diluted in 50–250 mL and infused over 15 minutes to 2 hours. This minimises stability and incompatibility problems and gives the 'peak' and 'trough' effect in antibiotic therapy. One of the advantages of intermittent IV administration is that the patient can have an intermittent venous access port, which increases client mobility, comfort and safety, as well as providing a cost benefit from not having continuous IV therapy; also the nurse does not have to continuously monitor flow rates.

When a drug must be highly diluted and a steady-state blood level is to be maintained, the continuous infusion method is used, in which the drug is diluted in 500–1000 mL and infused over 4–24 hours (e.g. potassium chloride requires high dilution and constant blood levels to prevent depression of cardiac function).

The IV flow rate may be controlled by using an infusion pump, a microdrip set or a burette. When a drug is added to the burette during intermittent infusion, details of the additive are indicated on a label that is attached to the burette. Any IV drug admixture must be prepared aseptically, mixed thoroughly and labelled with the name and amount of the additive, the name of the person adding the agent, the name of the person checking the addition and the time of starting the infusion. National recommendations for user-applied labelling of injectable medicines, fluids and lines now exist and it is imperative that nurses understand and comply with these as consequences of non-labelling can result in a potentially life-threatening situation for the patient. These recommendations include colour coding the route of administration (e.g. red for intra-arterial, blue for intravenous, yellow for epidural or intrathecal and beige for subcutaneous), the process for medicine and label preparation (including label placement), when to discard

containers of injectable medicines and special circumstances (ACSQHC 2016a). While these labelling recommendations do not apply to enteral, topical or inhalation routes, the general principles still apply as a way of improving practice and decreasing the risk of errors occurring.

An IV admixture should not be administered if there are signs of physical incompatibility such as a colour change, loss of clarity or precipitate formation. Chemical and physical compatibility and stability of admixtures should be checked *before* administration. If in any doubt, consult a pharmacist, textbooks, manufacturer's information or a drug information centre.

### Other administration routes

Drugs generally should not be mixed with blood or blood products.

Other methods of administering medications include the following:

- Transdermal patches, which deliver drugs through the skin at a steady concentration, avoiding first-pass metabolism in the liver and any gastric side-effects. Several types of drugs, including glyceryl trinitrate, hormones and nicotine, are available as transdermal patches. Advantages include ease of application and frequency of application (once daily or longer), but the disadvantages include some skin reactions and the low number of drugs available via this route.
- Intradermal implants, which are surgically implanted subcutaneously. Advantages include the frequency of administration (some may be implanted for 6–8 weeks or longer); however, they require surgical implanting and removal (e.g. etonogestrel (long-term contraception) is left in situ for 3 years before replacement).

## Guide for Safe Administration

Some drugs, such as Schedule 8, require double-checking; however, it is important that the double-checking procedure is an independent cognitive task (i.e. the nurse independently calculates the amount required as opposed to checking or glancing at someone else's calculations), rather than it being a superficial routine task. While double-checking is time consuming, it is central to patient safety and reducing drug errors (Ramasamy et al 2013).

### Check the order

- Check that the information on the drug name (preferably generic rather than trade name), dose, route, frequency, time due and when the drug was last given are all legible (if any doubt exists, withhold the drug and check with the medical officer) and that the order is signed by the medical officer.
- Check that patient details are correct, including any known allergies (it is important to discuss any allergy/sensitivity history with the patient as cross-sensitivity between products does occur).

### Check the drug

- Check the container label against the medication order when selecting the preparation, before measuring out and when replacing the preparation.
- Check the expiry date of the drug.
- Complete the drug calculation and then check the answer with another registered nurse, a pharmacist or medical officer (ask the second person to do the calculation independently, then compare answers, remembering

that it is rare to give less than half a tablet or more than 2 tablets or 1 ampoule at a time).
- Mix liquid contents thoroughly, but rotate or swirl protein preparations gently to prevent denaturation and frothing. If the reconstituted solution containing protein is further diluted, it should be gently inverted (not shaken) to ensure even mixing.
- Note any discolouration, precipitate or foreign bodies (and do not administer if they are present).

### Check the patient

- Check the patient's identity carefully (check wrist identity band or verbally), taking extra care if there are patients with the same or similar names, or if the patient is unknown to the nurse. An observational study of nurses administering medications found that 79% did not check the patient's identity before administration (Westbrook et al 2015).
- Check if the patient has any known allergies.
- Check that the patient knows the reason for the medication and discuss any query with the medical officer before giving it.
- Only give medications that you, the nurse, have prepared or seen a pharmacist prepare (i.e. do not administer an IV drug that was drawn up by someone else without you present).
- Give the correct drug and dose.
- Give to the correct patient.
- Give at the correct time.
- Give medication by the prescribed route.
- Do not handle tablets.
- Wait until oral medications are swallowed (never leave medications on bedside tables, lockers or dinner trays).

### Documentation

- Ensure that the drug administration sheet is signed after administration.
- Document any discrepancies (e.g. patient unable or refuses to take medication, patient absent, medication not available).
- If Schedule 8 drugs are involved, ensure that the drug register is correctly filled in (date, time, patient, drug (form, strength, amount to be administered), persons administering drug, balance of drug remaining, any drug discarded).
- Observe the patient and document in the patient's history.
- Note beneficial effects and/or report and chart any adverse effects (see brief discussion below).

### Disposal

- Correctly and safely dispose of equipment used (e.g. do not recap syringes, dispose of them safely in a sharps container; return unused medications to pharmacy).

#### Drug effects

A drug may produce more than one effect, which may be beneficial or not.

- The *desired action* is the physiological response the drug is expected to cause (e.g. antihypertensive medications are expected to lower blood pressure).
- *Adverse effects* refer to an unwanted effect which may or may not be dose related and is usually via a different mechanism to its pharmacological action.

- *Toxic effects* develop after prolonged administration of high doses of medication, or when a drug accumulates in the blood because of impaired metabolism or excretion. Some drugs, such as digoxin and lithium, have a very narrow safety margin and toxicity can occur at recommended or therapeutic doses.
- *Allergic reactions* are unpredictable responses to a drug that acts as an antigen, triggering the release of antibodies. Allergic reactions may be mild (such as urticaria (hives) and pruritus (itching)), or they may be severe (e.g. severe wheezing and respiratory distress), or life threatening (e.g. anaphylactic reaction). Some reactions occur within minutes of the drug being given (e.g. penicillin, streptomycin, radiological contrast media), while other allergic reactions may be delayed for hours or days (e.g. contact sensitivity to local anaesthetic cream).
- *Idiosyncratic reactions* are those where the patient's body either overreacts or underreacts to a drug, or when the reaction is unusual and there is no known cause (e.g. the antihistamine promethazine (Phenergan) is sometimes used for sedation; however, in some people (especially children) it can cause insomnia and agitation).
- *Pharmacogenetic reactions* occur because a person may have a genetic trait which leads to abnormal reactions to drugs (e.g. those with glucose-6-phosphate dehydrogenase (G6PD) deficiency may experience haemolysis if given dapsone, nitrofurantoin, primaquine or sulfamethoxazole) (Bryant et al 2019).
- *Drug tolerance* may also occur where a person has a decreased response to a drug over time, necessitating an increase in dosage to achieve the required response (Bryant et al 2019).
- *Drug interactions* occur when one drug modifies the action of another drug (e.g. a drug may either increase or decrease the action of other drugs). A drug interaction may be synergistic (enhances the effects of another drug) (e.g. probenecid may be given orally before IM procaine penicillin to increase and prolong the serum level of penicillin), antagonistic (opposes the effects of another drug) (e.g. protamine sulphate can be given to neutralise the anticoagulant effects of heparin) or additive (where the two drug actions are added together (e.g. when alcohol is consumed by a person on heparin, the risk of bleeding is significantly increased)).

## Summary

Administering medication is one of the nurse's most important responsibilities and should be treated with the due care it demands. It is not a task merely to be completed, but rather an opportunity for nurses to increase their own knowledge, to ensure that patients have been educated regarding their medications and to observe patients for both expected and unexpected responses – part of holistic nursing care. The right patient has a right to receive the right dose of the right medication in the right form at the right time by the right route for the right duration of therapy. If any doubt exists, the medication should be withheld; remember, WHEN IN DOUBT, DON'T!!

## AT A GLANCE

### Available Forms

This section outlines the various formulations for the medication.

### Action

Because this is not a pharmacology text, only a brief description of the action of each agent is included. For more detailed information, a pharmacology text should be consulted.

### Use

The most common uses of drugs (including both hospital and community uses).

### Dose

Dosages listed in this book are those for the *average adult* (unless otherwise stated). Occasionally a paediatric dose may be included if that particular agent is used predominantly in children (e.g. growth hormone, agents used to treat attention deficit hyperactivity disorder (ADHD)).

#### Adverse effects

Adverse effects are generally unwanted effects, some of which are predictable and often dose related. Other adverse effects may be unpredictable and occur less frequently (e.g. anaphylaxis, anaphylactoid reaction). Very common adverse effects are considered to be those that occur in 10% or more of study participants. Common adverse effects are found in 1–10%, uncommon in 1–0.1%, and rare adverse effects occur in less than 0.1%. The adverse effects listed in this book are generally those that are common or very common, and rare or less common adverse effects are listed when they require some action to be taken. For example, thrombocytopenia may be a rare adverse effect, but there is a requirement for regular monitoring of blood counts.

### Interactions

Interactions occur when one drug alters the action of the second drug, or both agents affect each other. As with the adverse effects, the interactions listed are those that occur commonly or are the most dangerous. It should be noted, however, that interactions between any agents are always possible and caution should be taken when multiple agents are given. For detailed explanations of how and why interactions occur, a pharmacological text should be consulted.

### Nursing points/Cautions

The points in this section are those most directly applicable to nurses and include:

- IV administration rate
- monitoring advice
- reconstitution and dilution requirements
- incompatibilities
- any specific storage requirements (e.g. refrigeration)
- cautions (e.g. particular patient groups that may need extra monitoring) and contraindications.

### Patient teaching and advice

Included in this section is important information that the patient should receive about their medication and includes:

- taking with food or fluids
- dividing of tablets
- grapefruit juice incompatibility

- driving warning
- when to seek medical advice (see following section for detailed patient teaching and advice information)
- advice regarding contraception if medication causes problems during pregnancy (e.g. teratogenic causing fetal malformations; use of effective contraception during and for some time after last dose).

It is assumed that the nurse will:

- use an aseptic technique when reconstituting medication
- inspect the solution for any particulate matter or cloudiness
- not use the medication if either particulates or cloudiness are present
- administer the medication using a safe, aseptic and correct technique
- dispose of sharps in a safe and responsible manner.

These points *are not* made for every parenteral agent in the text.

- 'Cautions' are the equivalent of amber traffic lights – go slow and take care. For example, a person with renal impairment may not excrete the medication at the same rate as someone with normal renal function, thus increasing the risk of adverse effects and toxicity. Therefore, a reduced dose may be required and/or close monitoring of renal function and drug excretion, as well as monitoring for adverse effects.
- 'Contraindications' are the equivalent of red traffic lights – no go!
  - hypersensitivity to the agent itself is not listed for every agent as it is assumed that this will be checked routinely before administration (i.e. the patient will be asked 'Have you had this medication before? Did you have any problems with it?'). Although cautions and contraindications are often more relevant to the person prescribing the medication, it is important that the nurse is also aware of these factors.

## GENERAL PATIENT TEACHING AND ADVICE

Patient teaching and advice regarding medications is an essential part of care, which often involves the nurse, in addition to the pharmacist, doctor and/or other members of a multidisciplinary team. If possible, take the time to build a rapport with the patient (and their significant other/carer/family member, if appropriate). It is easier to learn from and ask questions of someone you are comfortable with. Also, given the extent of this educational task, it should start on admission rather than a few days before (or on the day of) discharge.

There are a number of factors which may impact on a person's ability to learn (Roach 2005), including the following:

- *Environment and available time:* It may be difficult to teach and/or learn in an area where there are constant distractions or interruptions. Consider using a small room where the door can be closed and at a time when the nurse knows there will not be any interruptions (e.g. not during meal breaks or at other times of reduced staffing or during visiting hours). Although accessing a small

room may not be possible, pulling the curtain around the person's bed may alert others that something is taking place, even if it doesn't really afford privacy (curtains are not soundproof). The nurse should also consider how much time they have available to conduct the session. A short session crammed with too much information may cause confusion for the patient, as well as potentially leading to important information being overlooked.

- *Pain and/or discomfort:* Are you able to concentrate if you are tired, in pain, need to go to the toilet, are hungry or thirsty? All of these impact on a person's capacity to concentrate and should be eliminated or minimised before starting a teaching session.
- *Sensory deficits:* Does the patient have a hearing impairment? Do they have a hearing aid? Do they have it in (and is it turned on)? Can the person read the label on the medication bottle or graduations on a syringe? Is the person dexterous enough to open medication bottles or operate an injector pen or glucometer? Does the person have sufficient coordination to use an inhaler or is a spacer device required?
- *Anxiety/stress/fear:* These are similar to pain and discomfort and should be minimised or alleviated before starting a teaching session.
- *Learning styles:* Not everyone learns in the same manner. Some people learn by reading, others require demonstration, while others may require both (e.g. to demonstrate an injection or puffer technique get the patient to practise, as well as leaving literature for them to read). Consider your own learning style(s) – how do you prefer to learn about a new piece of equipment: play with it until you work out how it works, have it demonstrated to you, read the instruction manual from cover to cover or a combination of two or more methods? We often teach others in the manner we like to learn, therefore we should also consider teaching using the other, less comfortable ways. Allowing the patient to practise the skills (e.g. injection technique, blood glucose monitoring, puffer technique) gives the nurse an opportunity to observe and anticipate any problems (e.g. the patient may require follow-up by a district nurse on discharge to ensure the technique is correct).
- *Literacy:* Information should be presented at a level that takes into account the patient's education and reading level.
- *Language and culture:* Is an interpreter required? Does consideration need to be given to the nature of the material (e.g. contraception) and the genders of the teacher and patient? It is very difficult to give important information to someone who does not speak the same language as yourself, or who may be able to understand but not able to ask questions. Furthermore, it is important to use a professional interpreter if possible, as using family members (especially children or adults of the opposite sex) can put them into situations where they are not comfortable (e.g. a teenage son interpreting for his mother who is taking medication for gynaecological problems).

There are also issues of privacy and patient confidentiality to consider, as well as possible misinterpretation, giving incorrect drug and dosing information, or family members withholding information. It is also necessary to remember these issues of language and culture if giving the patient written information.

Before starting any teaching session, it is important to lay down the 'ground rules' (e.g. how long the session will last, what is going to be discussed, follow-up). Factors which can be alleviated or minimised should be attended to before starting the session. Other general considerations may include the following:

- *Use of appropriate language:* Nurses (and medical professionals in general) often use jargon (e.g. doing 'obs' or the 'meds'), which can be confusing (and daunting or overwhelming) for non-medical people.
- *Speed of conversation:* It is important to consider how quickly the information is delivered (i.e. how quickly does the nurse/doctor/pharmacist/allied health professional talk?) as this can lead to misunderstandings, especially if the patient is elderly, has a hearing impairment or is from a non-English speaking background (e.g. a patient may be too embarrassed to say they have not understood information because the person is speaking too quickly). Furthermore, when the health professional is feeling rushed, they may also speak faster.
- *Previous knowledge and skills of the person:* Even if the patient has been prescribed the medication before, assessing knowledge and any misunderstandings can be important as this may improve the patient's motivation to take the medication, thereby improving adherence with the regimen. If the medication is new, it is important to determine if the information and/or skill (such as using an inhaler or administration of insulin) requires more than one session, making discharge planning essential. This extra time gives the patient time not only to practise skills (supervised and/or unsupervised), but also to ask questions and seek clarification on anything that they have not understood (Roach 2005).
- It is important to return at an agreed time to review information and follow up on any other questions the person may have.

Consideration should be given to including the following as part of patient teaching and advice:

- Why is the person taking the medication (including the benefits)? If the person has any concerns about taking the medication, they should be encouraged to discuss these with their doctor before starting.
- Provide a simplified explanation of how the medication works (however, it is important not to be condescending).
- The importance of telling other health professionals (e.g. dentist, specialist, surgeon, anaesthetist) that they are taking medications (e.g. it may be necessary to discontinue some medications before a procedure). This should also include the patient reminding the health professional of any allergies (including to food(s) or latex) or other medical conditions (past or present) (such as kidney impairment, asthma, tuberculosis, hepatitis B, heart failure, cancer, blood disorders, gastric ulcer

or bleeding, diabetes, high blood pressure), whether they smoke or regularly drink alcohol.
- The importance of telling the doctor if the patient is pregnant, planning to become pregnant, breastfeeding or planning to breastfeed as many medications cross the placental barrier and/or are excreted in breastmilk.
- Ensuring prescriptions are filled in a timely manner so that the medication does not run out.
- A recommendation that the patient carries a list of current medications (with exact names) in their wallet/purse so that they can ensure that any other health professional knows what is being taken rather than a general description (e.g. 'small blue pill for my heart'). This may also be important in the event of an emergency.

## Dosage

- Name and strength of the medication (including information about differing strengths and trade names).
- What the medication looks like (e.g. capsules, tablets, liquid, injection).
- Dose – this may be straightforward (e.g. patient is ordered 10 mg and tablets are supplied as 10 mg) or not (e.g. patient is ordered 15 mg and tablets are supplied as 10 mg which means splitting one tablet. Depending on the dexterity of the person or the size of the tablet, this may not be a simple task. Is a pill splitter required?)
- When to take (e.g. morning, evening, same time every day, in relation to food or other tablets, once per week, once per month). It can be useful to specify a day. This can make adherence to the regimen simpler.
- Not increasing, decreasing or stopping medication without seeking advice from the doctor.

## How to Take

- Swallow whole with glass of water (or other fluids as recommended). Some fluids may interfere with the medication and it is important to know which ones to avoid.
- Importance of taking with or without food. Some medications need to be taken on an empty stomach, so instructions will include an hour before or 2 hours after food.
- Tablets/capsules should generally not be chewed (unless the tablets are chewable), broken, opened or crushed (however, this is dependent on specific medication).
- Techniques (such as inhalation using a puffer or injection) will need to be demonstrated and taught. If the patient is unable to manage, consideration should be given to teaching a carer/family member/significant other, involving a community-based service (e.g. district nursing service) or discussing with a doctor the appropriateness of the medication and the risk of non-adherence with the regimen.
- What to do if a dose is forgotten, omitted or vomiting occurs soon after an oral medication (e.g. seeking advice from a pharmacist or doctor; not taking a double dose to 'catch up').
- What to do if too much medication is taken (e.g. contacting doctor, pharmacist or Poisons Information Centre (131 126 in Australia or 0800 764 766 in New Zealand), going to the nearest Accident and Emergency Department).

- Length of time that the medication will be required (including emphasis on completing the course and not stopping the medication abruptly or without seeking medical advice).
- Whether there is anything that should be avoided while taking the medication (e.g. certain foods or fluids, alcohol, standing up quickly, not lying down after taking medication).

## Adverse Effects

- All medications cause some side/adverse effects. Some of these may be common, mild and transient in nature, while others are more serious (and life threatening). It is important for the patient to be made aware of any potential side/adverse effects that may require immediate medical attention. Caution should be taken with explaining side-effects (e.g. some patients may become anxious or frightened by potential side-effects and not take medications at all). It may be safer and simpler to suggest seeing a doctor immediately if anything unusual occurs. However, sometimes it is important to give specific directions, such as 'report to your doctor immediately if you develop any yellowing of the skin or whites of the eyes, your urine looks darker than usual, you develop nausea, vomiting or abdominal pain'.
- Life-threatening side-effects (such as allergic reaction, including development of wheezing, shortness of breath, rash, skin blistering, difficulty swallowing) should be emphasised as requiring urgent and immediate medical attention (e.g. call an ambulance rather than going to a medical centre).

## Storage

- All medications should be kept out of reach of children.
- Medications should be correctly stored. If there are special storage requirements (such as refrigeration) these should be emphasised (e.g. not using if left out of the fridge for 12 hours or more).
- Medications should not be stored in a bathroom, near a sink, on a windowsill or in the car as heat and dampness may destroy them.
- Most medications should not be frozen.
- Medications should be kept in the original containers/packets with labels intact. Medication should not be taken if the packaging/container is torn or has signs of being tampered with.
- If the medication changes colour, becomes cloudy, has foreign particles present or develops an odour, it should not be used and a pharmacist should be consulted immediately.
- Medications have a 'use by' (or expiry) date and should not be used after this date. It is important to show the patient where this information is located (it can be difficult to see on some containers). Some medications, such as eye drops, ointments and oral suspensions/mixtures, may have a very short life and deteriorate chemically with time, so it is important to write the date opened so that the person knows when to dispose of them.
- Expired medications or medications that are no longer needed should not be disposed of in general waste or sewerage as they end up in landfill and may be damaging to the

environment by ending up in waterways or may be found by children or animals. The Australian Government has established a National Return and Disposal of Unwanted Medicines program, which collects medicines returned to pharmacies and incinerates them according to Environmental Protection Authority (EPA) requirements (The National Return and Disposal of Unwanted Medicines Ltd 2020).

## Other Issues

- Follow all instructions on package/container (e.g. 'shake well before use', 'keep refrigerated', 'take 1 hour before meals').
- Seek advice from doctor if symptoms do not improve or worsen.
- Attend doctor's appointments as requested, including the need for regular blood or other tests to monitor drug levels (e.g. some medications, such as warfarin, require regular monitoring of the therapeutic blood level and the dosage may need to be adjusted accordingly).
- The importance of having a current prescription and getting it filled/refilled before the medication runs out (especially if planning to take a holiday).
- Medications should not be given to others with similar conditions, nor kept for next time the condition recurs (e.g. antibiotics used to treat respiratory infection).
- OTC medications (such as simple analgesics, antacids, laxatives, cold and flu preparations) and herbal preparations or vitamins/minerals may interact with prescribed medications. It is important to consult with the doctor or pharmacist before taking any of these preparations (including those bought from the supermarket or health food stores).
- Consideration should be given to wearing a MedicAlert pendant or bracelet or some other form of identification for some conditions/medications (e.g. diabetes, anticoagulants, corticosteroids, insulin) in case of an emergency.
- Is the patient able to manage the medications alone (e.g. it may be appropriate to suggest using a dose administration aid (DAA) (e.g. Dosette box)? (See discussion on p. xviii regarding the suitability of patients for administration aids.) Involve a carer in any discussions or refer the patient to a community-based agency (such as the district nursing service) for monitoring). This may also include the ability to open containers or split tablets if needed. Most pharmacies will provide a unit-dose packing service on request at a cost.
- Warn patient against driving or operating machinery until they know how the medication will affect them. This is particularly important if the medication has known side-effects that affect vision, balance, coordination or reaction time or increases the effects of alcohol. If this is a known occurrence, extra labels will be attached to containers/packages (e.g. 'this medication may cause drowsiness and may increase the effects of alcohol. If affected, do not drive a motor vehicle or operate machinery').
- Other medication-specific considerations are discussed under patient teaching and advice in each section.

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# ACNE TREATMENT

Although a small number of adults (often women) continue to experience acne vulgaris, it is commonly a disorder of teenagers and young adults. After puberty there is an increased sebum production, and blocked follicles result in small cysts (comedones) containing sebum and keratinous material. *P. acnes* acts on the sebum leading to release of free fatty acids, which results in inflammation and cyst rupture (Lawley et al 2018; Harris & Cooper 2017).

There are a number of types of lesions that appear in acne vulgaris, including comedones (closed – whiteheads, open – blackheads), papules, pustules, nodules, cysts and scars. Distribution follows the areas of the body with the greatest number of pilosebaceous glands, namely face, neck, chest and back (Harris & Cooper 2017). Comedones are most common on the forehead and cheeks. Papules may evolve quickly over a few hours, are often itchy or painful and become pustules which resolve over a few days (Lawley et al 2018). Nodules and cysts, however, are a sign of deeper inflammation, are more uncomfortable and take longer to resolve. Scarring is a common result, especially if the lesions are scratched, picked or squeezed. For the person experiencing acne, the number or severity of the lesions may not be in proportion to the emotional impact it has on them. It has been found that the severity of the acne tends to be underestimated by the doctor and overestimated by the patient, and a few 'zits/spots' are likely to cause as much angst as many lesions in a teenager. Regardless of the severity of the acne, patients are at greater risk of anxiety and depression compared to those with no acne (Lawley et al 2018; Harris & Cooper 2017; Zaenglein et al 2016).

A number of medications can cause eruptions or worsen pre-existing acne. These include glucocorticoids (topical and systemic), phenytoin, lithium, isoniazid, oral contraceptive pills and androgenic steroids. Genetic factors and polycystic disease may also play a role in the development of secondary acne. Other factors known to aggravate acne include friction and trauma to the area (e.g. chin straps, headbands), some topical preparations (e.g. cosmetics, hair preparations) or exposure to certain industrial compounds (Lawley et al 2018).

Management of acne should always commence with face hygiene using a

soap-free face wash and use of oil-free moisturisers, especially after topical treatments (Harris & Cooper 2017). Treatment of mild-to-moderate acne is usually topical (e.g. topical retinoids, benzoyl peroxide, azelaic acid or salicylic acid), while topical antibacterial agents (e.g. erythromycin, clindamycin) are used as adjuncts. Moderate-to-severe acne is managed with systemic therapy (e.g. minocycline, doxycycline), while oral retinoids are used to manage severe nodulocystic acne that is unresponsive to other therapies. Therapy can be one agent alone (monotherapy) or a combination, with combination therapy being recommended for most patients with acne, as a number of aspects of the disease process are treated simultaneously (Lawley et al 2018; Zaenglein et al 2016). Other therapies for acne management include chemical peels, light, laser and radio frequency; however, there is little long-term research or evidence in these areas to support the use of these treatments. There is some evidence to suggest light therapy is both safe and effective in acne treatment (Harris & Cooper 2017).

## RETINOIDS

### General Actions of retinoids

- analogues of vitamin A
- cause epidermal hyperplasia, decreased hyperkeratosis, inhibit sebum production and decrease size of sebaceous glands
- (acne) assist in the extrusion of fatty substance from comedones and prevent reblocking and formation of new lesions
- some anti-inflammatory action

### General Adverse effects of oral retinoids

- pruritus, rash, skin thinning and scaling (especially palms, soles), dermatitis, sticky skin, dry skin, erythema, skin fragility, bullous eruptions
- eye irritation, decreased night vision, conjunctivitis, dry eyes, blurred vision, contact lens intolerance, xerophthalmia
- headache, depression, fatigue, somnolence, anxiety, mood swings
- cheilitis, dry mouth and/or lips, taste disturbance, cracked corners of mouth and lips
- nausea, vomiting, abdominal pain, inflammatory bowel disease, diarrhoea, stomatitis, gingivitis
- flushing
- paronychia, nail fragility
- tinnitus, hearing impairment
- arthralgia, arthritis, myalgia (with or without elevated creatinine phosphokinase (CPK)), joint and bone pain
- drying of mucous membranes, leading to epistaxis or rhinitis
- reversible alopecia, abnormal hair texture
- increased serum cholesterol and triglycerides, raised liver enzymes
- alteration to blood glucose levels
- (uncommon) photosensitivity
- (rare, high dose) corneal opacities, erosions or ulceration
- (rare) benign intracranial hypertension (pseudotumour celebri), skeletal hyperostosis, allergy, suicide, suicidal ideation, pancreatitis, gynaecomastia
- (overdose, hypervitaminosis A) transient headache, vomiting, facial

flushing, dizziness, cheilosis, abdominal pain, ataxia

**General Interactions of oral retinoids**

- contraindicated with tetracyclines because of risk of benign intracranial hypertension
- contraindicated with other retinoids or vitamin A due to increased risk of hypervitaminosis A
- not recommended with alcohol (especially in women of childbearing potential)
- may reduce efficacy of progestogen-only oral contraceptives

## General Nursing points/Cautions for retinoids

- before starting therapy, patient should be assessed for any family history of lipid disorders or obesity, alcohol abuse, diabetes or smoking
- liver function should be monitored before starting therapy, weekly during the first 2 months and then at 3-monthly intervals during therapy
- blood lipids (triglycerides and cholesterol) should be monitored before starting and then 1–2 weekly until lipid response is determined (usually 4–8 weeks), then regularly throughout therapy (especially if there is a predisposition to lipid disorders, including family history, diabetes mellitus, obesity or increased alcohol intake)
- exacerbation of cystic acne or psoriasis may occur during initial stages of treatment
- (long-term therapy) patient should have regular X-rays during therapy to monitor for signs of new, or changes in, bony abnormalities of the spine
- if used in those under 18 years, bone growth and development should be regularly monitored by X-ray and measurement
- caution if used in those with diabetes as glucose tolerance may be affected. Blood glucose levels should be closely monitored, especially at the start of therapy, as they may be elevated
- caution if used in those who have been previously exposed to topical retinoids as this increases the risk of allergic reactions (purpura, allergic vasculitis)
- caution if used in those who have not reached puberty as retinoids may cause premature closure of epiphyseal plates
- caution if used in those with pre-existing or history of depression, psychosis or intestinal disorders
- contraindicated in those with hypersensitivity to any retinoid products, severe liver or kidney impairment, chronically elevated blood lipids or pre-existing hypervitaminosis A

## General Patient teaching and advice for retinoids

**Topical therapy**

- warn patient that condition may initially appear worse
- advise patient to avoid excess sunlight or sunlamps and wear protective clothing and sunscreen with high protective factor (SPF 30+) when going outdoors
- patient should be advised to avoid extremes of weather/temperature (e.g. wind, extreme cold) during therapy
- if patient becomes sunburnt, therapy should be discontinued until the skin has completely recovered

- patient should be warned to wash hands before and after applying gel/cream
- instruct patient to use moisturising cream/lotion on skin and use lip balm, lubricating eye ointment or tear replacement therapy to overcome some drying of skin, lips and eyes caused by the retinoid therapy
- advise patient to first wash skin with mild soap and dry before applying gel or cream as per directions, but avoid excessive application
- moisturisers and emollients may be used with retinoid cream, but should be allowed to dry before applying second cream
- avoid application of gel or cream to mucous membranes, eyes, mouth, corners of nose or broken skin. If contact occurs, area should be thoroughly rinsed with water
- to avoid risk of dermatitis, scarring or epidermal stripping, wax epilation should be avoided during and for 5–6 months after stopping therapy
- dermabrasion and laser therapy should be avoided during and for 5–6 months after stopping therapy, because there is an increased risk of hypertrophic scarring and/or skin pigmentation changes
- warn patient not to apply gel/cream more frequently or in greater quantity than prescribed as this may cause redness, stinging and discomfort and does not increase effect
- if other topical acne products (e.g. benzoyl peroxide) are also used, they should be applied at different times (e.g. retinoid gel/cream in the evening, other therapy in the morning)
- if severe redness, peeling or discomfort occurs, patient should be advised to decrease frequency of application or use cream/gel of lower strength (if available)

**Oral therapy**

- warn patient that condition may initially appear worse
- patient should be instructed to swallow capsule whole. If capsule is opened, absorption will be altered
- instruct patient to immediately report any:
  - abdominal pain, rectal bleeding or severe diarrhoea (especially containing blood)
  - visual disturbances, such as blurred vision, decreased night vision or eye irritation
  - hearing loss or ringing in ears
  - skin reactions
  - headache, nausea, vomiting or visual disturbances (if they occur, patient should be screened for papilloedema)
  - sadness, crying, sleeping too much or not being able to fall asleep, change in appetite, trouble with concentration, withdrawal from family, friends and/or previously pleasurable activities, lack of energy and/or thoughts of self-harm
- patient should be advised to avoid driving or operating machinery if vision (especially night vision) is affected
- instruct patient not to take vitamin A supplements (or other vitamin supplements containing vitamin A) during therapy
- patients wearing contact lenses should be warned of decreased tolerance during initial therapy
- patient should be instructed not to donate blood during and for 1 month

(isotretinoin) or 3 years (acitretin) after stopping therapy
- patients with diabetes mellitus may find their glucose tolerance is affected and therefore regular monitoring of blood glucose is suggested
- patient should be advised to avoid alcohol (as a drink or in food or medicine) during and for 2 months after stopping therapy, because alcohol slows the elimination of retinoids
- male patients should be reminded to not share medications, especially with women of childbearing potential or if pregnant
- all women (including those who are not sexually active or have amenorrhoea) should be counselled regarding the importance of using effective contraception
- women of childbearing potential should be given both oral and written information regarding the teratogenic and embryotoxic potential of retinoids. The woman needs to agree to use effective contraception (preferably two different complementary methods, such as oral contraceptive plus condom/diaphragm), starting 1 month before commencement, during and for 3 years following therapy. A negative serum or urine pregnancy test should be completed within 1 week of starting therapy. Monthly pregnancy testing is recommended throughout therapy and for 1–3 months after stopping. Therapy should be started on day 2 or 3 of the menstrual period. Women should also be advised that taking acitretin with alcohol produces etretinate, which is teratogenic, and therefore alcohol should be avoided during therapy and for 2 weeks after stopping. If pregnancy occurs, patient should be counselled regarding continuation or termination given the possible teratogenic effects on the fetus
- pregnant patient should be warned to avoid opening capsules and making contact with powder
- see also General Patient teaching and advice (p. xxvii)



**contraindicated during pregnancy and breastfeeding**

## ACITRETIN (Neotigason, Zetin)

### Available forms
Capsules: 10 mg, 25 mg

### Action
- see General Actions of retinoids (p. 2)
- metabolite is teratogenic
- half-life 50 hours

### Use
- psoriasis
- severe keratinisation disorders

### Dose
- (psoriasis) initially 25–30 mg orally once daily with food for 2–4 weeks, followed by 25–50 mg daily for 6–8 weeks **OR**
- (keratinisation disorders) 20 mg orally daily, adjusting dose according to clinical response (daily maximum 50 mg)

### Adverse effects
- peripheral oedema
- see also General Adverse effects of oral retinoids (p. 2)

### Interactions
- contraindicated with methotrexate due to increased risk of hepatitis

- not recommended with minocycline or doxycycline due to risk of additive toxicity
- see also General Interactions of oral retinoids (p. 3)

### Nursing points/Cautions

- see General Nursing points/Cautions for retinoids (p. 3)
- (psoriasis) therapy should be stopped when lesions have resolved and any relapses treated as previously

### Patient teaching and advice

- patients should be advised to take capsules with milk or food
- (psoriasis) patient should be warned that psoriasis may appear worse during early treatment
- see General Patient teaching and advice for retinoids (oral therapy) (p. 3)

## ISOTRETINOIN (Dermatane, Oratane, Roaccutane, Rocta)

### Available forms

Capsules: 5 mg, 10 mg, 20 mg, 40 mg

### Action

- see General Actions of retinoids (p. 2)
- half-life 10–20 hours (half-life of major metabolite 11–50 hours)

### Use

- severe cystic acne (unresponsive to conventional therapy including systemic antibiotics)

### Dose

- (severe cystic acne) initially up to 0.5 mg/kg orally daily as a single or 2 divided doses with food for 2–4 weeks, then dose adjusted according to clinical response (for total of 16 weeks)

### Adverse effects

- see General Adverse effects of oral retinoids (p. 2)
- (rare) inflammatory bowel disease

### Interactions

- see General Interactions of oral retinoids (p. 3)

### Nursing points/Cautions

- see General Nursing points/Cautions for retinoids (p. 3)
- (cystic acne) second course of treatment should not be within 8 weeks of first course

### Patient teaching and advice

- capsules contain soy, so caution should be used in those with soy or peanut allergy
- see General Patient teaching and advice for retinoids (p. 3)

## TAZAROTENE (Zorac Cream)

### Available forms

Cream: 0.5 mg/g, 1.0 mg/g

### Action

- retinoid prodrug which is converted to active tazarotenic acid
- see General Actions of retinoids (p. 2)

### Use

- plaque psoriasis
- mild-to-moderate acne

### Dose

- (plaque psoriasis) apply thin film over lesions nightly, starting with 0.5 mg/g strength cream and, if tolerated, increasing to 1.0 mg/g strength OR
- (acne) apply thin film over acne lesions nightly (1 mg/g only)

### Adverse effects

- dry skin, erythema, peeling, burning, pruritus, irritation, stinging, skin discolouration, rash, contact dermatitis
- face pain
- temporary worsening of acne or psoriasis

### Interactions

- caution if used with other agents known to cause photosensitivity (e.g.

thiazides, phenothiazines, sulfonamides)
- (gel) not recommended with other topical medication, especially peeling agents such as resorcinol, benzoyl peroxide, sulfur or salicylic acid

### Nursing points/Cautions

- see General Nursing points/Cautions for retinoids (p. 3)
- contraindicated on eczematous skin

### Patient teaching and advice

- patient should be warned that skin may sting or have a burning sensation at the start of treatment
- see General Patient teaching and advice for retinoids (topical therapy) (p. 3)

## TRETINOIN (ReTrieve Cream, Stieva-A, Vesanoid)

### Available forms

Cream: 0.25 mg/g, 0.5 mg/g, 1 mg/g; Capsules: 10 mg

### Action

- see General Actions of retinoids (p. 2)

### Use

- acne vulgaris where comedones, papules and/or pustules predominate
- dry skin due to photoageing
- acute promyelocytic leukaemia (Vesanoid only)

### Dose

- (acne vulgaris) applied to acne lesion(s) nightly for at least 6–8 weeks; frequency may be decreased when acne responds satisfactorily to treatment (Stieva-A) **OR**
- (dry skin due to photoageing) wash and dry skin, then:
  - night 1: apply cream to skin and leave for 5 minutes, then wash off
  - night 2: apply to skin and leave for 10 minutes, then wash off
  - nights 3–6: increasing time by 30 minutes per night until left on for 120 minutes. If no redness or irritation occurs next day, cream can be left on overnight and washed off in the morning. If skin reaction occurs, apply every second night until skin tolerance increases (ReTrieve Cream)

### Adverse effects

- transient stinging, feeling of warmth, peeling, erythema, temporary changes to skin pigmentation
- photosensitivity
- reversible elevation of liver enzymes and bilirubin
- (rare) allergy, contact dermatitis

### Interactions

- not recommended with other topical medication, especially peeling agents such as resorcinol, benzoyl peroxide, sulfur or salicylic acid
- caution if used with other agents known to cause photosensitivity (e.g. thiazides, phenothiazines, sulfonamides) or those containing high concentrations of alcohol, menthol, lime or spices

### Nursing points/Cautions

- not recommended as monotherapy for deep cystic nodular acne or severe pustular acne
- caution if applied to neck or other sensitive areas
- not recommended for eczematous skin
- not recommended in those with personal or family history of skin cancer
- see General Nursing points/Cautions for retinoids (p. 3)

### Patient teaching and advice

- advise patient that it may take more than 6 weeks for effects to be seen

and treatment should be continued for at least 12 weeks
- see General Patient teaching and advice for retinoids (topical therapy) (p. 3)

**Note**
- Vesanoid is used as an antineoplastic agent (p. 707), not as a general dermatological agent
- contained in Acnatac with clindamycin

# TOPICAL AGENTS USED IN ACNE MANAGEMENT

## ADAPALENE (Differin Topical Cream, Differin Topical Gel)

**Available forms**
Cream: 0.1%; Gel: 0.1%

**Action**
- retinoid-like properties
- modulates cellular differentiation, keratinisation and inflammatory processes
- normalises differentiation of follicular epithelial cells resulting in decreased microcomedone formation

**Use**
- acne vulgaris (with comedones, papules and pustules) of face, chest and back

**Dose**
- apply thin film to affected areas at night

**Adverse effects**
- redness, dry skin, burning sensation, scaling, skin irritation, pruritus, sunburn
- (uncommon) contact dermatitis, flu-like syndrome, headache

**Interactions**
- not recommended with abrasive cleansers, astringents, strong drying agents or irritants or other topical retinoids as there may be increased skin irritation

**Nursing points/Cautions**
- not recommended for those with eczema or seborrheic dermatitis

**Patient teaching and advice**
- advise patient to wash and dry affected area(s) thoroughly before applying cream/gel
- patient should be warned to avoid contact with eyes, lips and mucous membranes and if contact occurs, area should be washed immediately with copious amounts of water
- warn patients that preparation should not be applied to broken skin, reddened areas or sunburnt sites, or on skin with eczema or seborrhoeic dermatitis or if acne covers a large body area
- instruct patient to stop therapy if severe skin reaction occurs
- patient should be warned to use only oil-free moisturisers to manage dry facial skin
- advise patient to avoid excess sunlight or sunlamps and wear protective clothing and sunscreen with high protective factor (SPF 30+) when going outdoors



**not recommended during pregnancy or in women who plan to become pregnant**

**caution if used during breastfeeding and should not be used in chest area**

**Note**
- contained in Epiduo and Epiduo Forte with benzoyl peroxide (both are contraindicated during pregnancy or in women planning to become pregnant)

## AZELAIC ACID (Azclear Medicated Lotion, Finacea)

### Available forms
Gel: 15%; Lotion: 20%

### Action
- antibacterial action that acts on *P. acnes*, reducing number of bacteria, as well as reducing free fatty acids in the skin surface lipids
- penetrates damaged skin more rapidly than intact skin
- unknown action in rosacea, although thought to be anti-inflammatory

### Use
- mild-to-moderate acne vulgaris
- papulopustular rosacea

### Dose
- apply sparingly to affected area twice daily (morning and night) and massage into skin until it vanishes

### Adverse effects
- skin burning, pruritus, stinging, tingling, erythema, irritation, dry skin, scaling, rash
- skin discolouration/depigmentation (especially in darker skin)
- (uncommon) contact dermatitis, folliculitis, skin disorder, acne
- (rare) allergic reaction

### Nursing points/Cautions
- duration of therapy depends on the severity of disorder, but improvement is commonly seen in 4–8 weeks
- contraindicated in those with hypersensitivity to propylene glycol

### Patient teaching and advice
- instruct patient to wash skin thoroughly with water before applying gel or cream
- warn patients that adverse effects usually occur at the start of therapy. If adverse effects are severe, therapy should be stopped and the number of applications per day reduced
- advise patient to avoid contact with eyes and if this occurs eyes should be immediately rinsed with copious amounts of water
- patient should be warned that any skin discolouration or depigmentation is temporary
- see General Patient teaching and advice (p. xxvii)

## BENZOYL PEROXIDE (Benzac, Benzac AC Wash, Clean & Clear Continuous Control Acne Cleanser, Oxy Cream, Oxy Vanishing Cream)

### Available forms
Gel: 2.5%, 5%, 10%; Cream: 40 mg/g, 50 mg/g, 100 mg/g

### Action
- action not totally understood
- antibacterial action against *P. acnes*
- reduces lipids and fatty acids with mild drying and peeling action

### Use
- acne vulgaris

### Dose
- (days 1–3) wash and dry affected areas, apply gel once daily and leave on skin for 2 hours, then wash gel off
- (days 4–6) if no discomfort occurs, apply gel and leave overnight
- if no discomfort occurs and acne is resisting treatment, apply twice daily, once in the morning (and leave on all day), then wash the affected area and reapply at night (and leave overnight) OR
- (Benzac AC Wash, Clean & Clear Continuous Control Acne Cleanser) apply twice daily to affected area using the following instructions. Wet area to be treated and preparation applied to hands; wash affected area with solution, allowing skin contact for 30 seconds, followed by thoroughly rinsing area with water and drying

### Adverse effects

- skin dryness, erythema, peeling, pruritus
- allergic contact dermatitis

### Interactions

- not recommended with tretinoin, isotretinoin and tazarotene, as these may cause increased irritation and decrease retinoid efficacy
- caution if used with topical sulfonamide as skin or facial hair may turn orange/yellow temporarily

### Patient teaching and advice

- patient should be warned to wash hands before and after applying gel/cream
- advise patient that mild burning sensation occurs on application of gel/cream and moderate skin reddening and peeling will occur within a few days. Increased peeling and reddening will occur in the first week and then subside within 1–2 days
- warn fair-haired patients that they may be more prone to skin irritation
- if severe irritation occurs, advise patient to stop therapy until it clears and then restart at a decreased frequency
- warn patient to avoid contact with coloured material (e.g. material, hair) as bleaching or discolouration may occur
- cool compresses should be recommended to help reduce irritation
- if used with retinoid gel/cream, advise patient to apply at different times (e.g. benzoyl peroxide in the morning, retinoid in the evening)
- advise patient to avoid contact with eyes, mouth, sensitive neck areas, mucous membranes and angles of nose; if contact occurs, area should be washed thoroughly with water
- warn patient that preparation should only be applied to intact skin
- advise patient to avoid excess sunlight or sunlamps and wear protective clothing and sunscreen with high protective factor (SPF 30+) when going outdoors
- if patient becomes sunburnt, therapy should be discontinued until the skin has completely recovered
- warn patient that use with other topical acne preparations is not recommended due to added skin irritation
- see General Patient teaching and advice (p. xxvii)

### Note

- contained in Clearasil Ultra Acne Treatment Cream, Duac Once Daily Gel, Epiduo Gel and Epiduo Forte Gel

# ANALGESICS AND NON-STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDs)

The NSAIDs are a diverse group of compounds, often chemically unrelated, that share some therapeutic actions and side-effects because of their non-selective inhibition of cyclo-oxygenase (COX). Not all drugs in this class possess the anti-inflammatory, antipyretic and analgesic characteristics to the same degree. For example, paracetamol has antipyretic and analgesic properties, but is not useful as an anti-inflammatory. When used as analgesics, these drugs are usually effective against low-to-moderate intensity pain only. As anti-inflammatory agents, they are used in treating musculoskeletal disorders, providing symptomatic relief from pain and inflammation, but leaving the progression of the disease course unchanged. As antipyretics, they are thought to inhibit hypothalamic prostaglandins that act on the thermoregulatory centre in the hypothalamus. The COX-2 inhibitors are a newer class of agents with similar properties to those of other NSAIDs without having the same side-effects (especially gastrointestinal (GI)) because of their selective inhibition (Grosser et al 2018).

Most NSAIDs are taken orally, while some are applied topically to relieve muscular and/or rheumatic pain. Some are used in ophthalmic preparations to reduce ocular inflammation. A systematic review of the literature found that topical NSAIDs provide a good level of pain relief in acute conditions such as sprains, strains and overuse injuries, with gel preparations providing the best effects with minimal adverse effects (Derry et al 2019).

Simple analgesics are those that contain only one compound (e.g. 500 mg paracetamol), while compound analgesics combine two or more preparations. While this might be an advantage to the patient because only one tablet is taken, it can have its disadvantages as it is difficult for the clinician to titrate the dose or interval, may be more expensive and/or produce more adverse effects than the individual compounds (Bryant et al 2019).

In 2018, the Department of Therapeutic Goods Administration (TGA) amended previously Schedule 2 (Pharmacy Only) and Schedule 3 (Pharmacist Only) preparations containing codeine (e.g. Panadeine = paracetamol plus codeine) to become prescription-only (Schedule 4) (Therapeutic Goods Administration [TGA] 2018). This has resulted in a number of these codeine-containing

products no longer being produced by some manufacturers.

**General Actions of NSAIDs (not paracetamol)**

During the inflammatory response, arachidonic acid is converted by the enzyme cyclo-oxygenase (COX) to prostaglandins and thromboxane A2, and by the enzyme lipoxygenase to leukotrienes, which produce the pain, swelling, redness and heat associated with inflammation (Brenner & Stevens 2013). Cyclo-oxygenase is present in two forms that have distinct properties. Cyclo-oxygenase 1 (COX-1) is found in the stomach, intestines, kidneys and platelets, and appears to be responsible for functions involving prostaglandins, such as renal function, platelet aggregation and cytoprotection of the stomach. NSAIDs inhibit COX-1 non-selectively, resulting in the common side-effects of gastric ulceration and, to a lesser extent, renal toxicity and increased risk of bleeding. Cyclo-oxygenase 2 (COX-2) is found in fewer tissues (including the brain, renal glomeruli and vasculature) at low levels; however, during inflammation, pro-inflammatory substances lead to an increase in COX-2 levels. Selectively inhibiting COX-2 decreases the signs and symptoms of inflammation and pain, with less likelihood of causing gastric or renal problems (Grosser et al 2018).

**General Adverse effects of NSAIDs (not paracetamol)**

- epigastric pain, anorexia, nausea, vomiting, diarrhoea, abdominal pain/cramps, heartburn, dyspepsia, flatulence, constipation, gastritis
- rash, pruritus, erythema, urticaria, dermatitis, sweating, photosensitivity
- tinnitus, temporary deafness
- headache, dizziness, vertigo, fatigue, drowsiness, insomnia
- prolonged bleeding time, increased risk of bruising and bleeding
- fluid retention, peripheral oedema
- hypertension (new, or worsening of existing), palpitations, premature closure of ductus arteriosis
- increased risk of cardiovascular thrombotic events (COX-2 inhibitors)
- elevated liver enzymes (ALT, AST), decreased serum urea, hyperkalaemia
- blood dyscrasias, iron-deficiency anaemia
- may mask signs and symptoms of infection
- (females) may impair fertility by delaying or preventing rupture of ovarian follicles
- inhibition of labour, prolongation of gestation
- increased risk of myocardial infarction and stroke
- (prolonged therapy, high dose) visual disturbances (including blurred vision), acute interstitial nephritis with haematuria, proteinuria, nephrotic syndrome
- (rare) anaphylactoid reactions, angioedema, serious skin reactions, hypersensitivity reactions (especially in those with asthma or family history), aseptic meningitis
- (rare) GI bleeding and/or ulceration
- (rare) renal papillary necrosis, jaundice, hepatitis, liver toxicity

**General Interactions of NSAIDs (not paracetamol)**

- may increase blood lithium or digoxin levels (except ketoprofen), thereby increasing the risk of toxicity; lithium or digoxin levels should

be closely monitored, especially when starting or stopping therapy with NSAIDs
- use with aspirin or other NSAIDs is not recommended because of increased risk of GI side-effects
- use caution and close monitoring if warfarin is given with NSAIDs because of increased risk of haemorrhage
- increased risk of nephrotoxicity if tenofovir, ciclosporin or tacrolimus are given with NSAIDs
- methotrexate toxicity may occur if NSAIDs are given within 24 hours of methotrexate therapy
- use of quinolone antibiotics and NSAIDs may lead to convulsions (not celecoxib)
- risk of gastric ulceration is increased if aspirin or NSAIDs are taken with alcohol and/or corticosteroids
- not recommended with alendronate or nicorandil due to increased risk of gastric ulceration
- increased risk of bleeding if given with SSRIs, zidovudine, fibrinolytic or antiplatelet agents
- use of antacids may reduce absorption of aspirin or NSAIDs (except ketoprofen, ketorolac trometamol, sulindac and piroxicam)
- may decrease excretion of aminoglycoside antibiotics, increasing risk of toxicity
- avoid use with other nephrotoxic agents
- plasma levels may be increased if given with probenecid
- may increase serum potassium levels if given with potassium-sparing diuretics, increasing risk of nephrotoxicity. Renal function, potassium serum levels and blood pressure should be closely monitored if used together
- may decrease diuretic, natriuretic and antihypertensive effects of loop, potassium-sparing and thiazide diuretics by inhibiting the synthesis of renal prostaglandin
- may potentiate effects of sulfonylureas, therefore blood glucose levels should be closely monitored during therapy to prevent hypoglycaemia
- may reduce antihypertensive effects of beta-adrenergic blocking agents, ACE inhibitors and angiotensin II antagonists
- risk of renal impairment is increased if NSAIDs, thiazide diuretics and ACE inhibitors/angiotensin II antagonists are given together, especially in the elderly or those with pre-existing renal impairment
- may decrease efficacy of intrauterine device (IUD)
- not recommended within 8–10 days of mifepristone
- increased elimination if given with colestyramine
- increased risk of bleeding if given with *Ginkgo biloba*

### General Nursing points/Cautions for NSAIDs (not paracetamol)

- before starting therapy, the patient should be assessed for:
  - any allergic reactions after prior aspirin or other NSAID therapy, as cross-sensitivity occurs
  - any history of asthma (may induce asthma attack in susceptible individuals) or gastric ulceration/bleeding (due to increased risk of both) should be assessed before starting therapy
  - cardiovascular risk factors (such as hypertension, hyperlipidaemia, smoking, diabetes)

- if administered preoperatively, patient should be carefully monitored for any signs of bleeding intra- or postoperatively
- signs of infection such as fever can be masked by NSAID therapy
- regular ophthalmological examination, haematological and liver enzyme monitoring should all be performed during prolonged therapy
- in patients with concurrent hypertension managed with antihypertensive agents (beta-adrenergic blocking agents, ACE inhibitors and angiotensin II antagonists) regular measurement of BP is recommended before starting therapy and then at regular intervals
- caution if used in those with pre-existing oedema because of increased potential for fluid retention, peripheral oedema and increased blood pressure
- caution if given to those with pre-existing renal disease, uraemia or bleeding disorders
- caution if used in those with inflammatory bowel disease (IBD) as NSAIDs have been associated with exacerbation of IBD-associated spondyloarthropathies
- not recommended in those with uncontrolled hypertension, congestive cardiac failure, ischaemic heart disease or peripheral arterial disease
- contraindicated in those with a history of peptic or GI ulceration or bleeding
- contraindicated in those with bleeding disorders (e.g. haemophilia, von Willebrand disease)
- contraindicated in those with severe liver or kidney insufficiency or severe cardiac failure
- contraindicated in those with salicylate hypersensitivity (as cross-sensitivity between aspirin and other NSAIDs exists)
- contraindicated in those with 'aspirin triad' (person with asthma who experiences rhinitis with/without nasal polyps, or experiences severe bronchospasm after taking aspirin or NSAIDs)
- contraindicated post coronary artery bypass graft (CABG) surgery

### General Patient teaching and advice for NSAIDs (not paracetamol)

- instruct patient to take NSAIDs with food or milk (e.g. after meals) to reduce gastric irritation
- warn patient to avoid alcohol during therapy with NSAIDs to reduce risk of GI adverse effects
- patient should be warned to immediately report to their doctor any:
  - changes in hearing or visual disturbances
  - nausea, tiredness, lack of appetite, lethargy, itching, yellowing of skin, eyes, pale bowel motions and dark urine, flu-like symptoms or abdominal tenderness (in upper outer right quadrant) (as these are signs of impending liver toxicity)
  - breathlessness, difficulty breathing when lying down, any swelling in feet or legs (signs of cardiac failure)
  - sudden and oppressive chest pain (may be sign of heart attack)
  - severe stomach or throat pain, vomiting blood or black vomit, bleeding from rectum, sticky bowel motions
  - skin rash, hives, blistering or peeling skin, mouth ulcers or swelling

of face, lips, mouth, tongue or throat, or wheezing/difficulty breathing occurs
  - changes to the amount or colour of urine passed, any blood in urine
- caution patients not to drive or operate machinery if dizziness, drowsiness or visual disturbances occur
- warn patients with diabetes using oral hypoglycaemic agents to monitor blood glucose levels carefully during therapy to prevent hypoglycaemia
- advise female patient if she is having a problem becoming pregnant, NSAID therapy should be stopped
- counsel female patients not to take NSAIDs during pregnancy, especially during third trimester. If the patient becomes pregnant, she should be advised to tell her doctor immediately

**Topical gel/solution**

- advise patient to avoid excess sunlight or sunlamps and wear protective clothing and sunscreen with high protective factor (SPF 30+) when going outdoors as some topical gels can increase skin sensitivity and therefore risk of burning
- instruct patient to wash hands before and after applying gel and avoid contact with eyes or mouth
- warn patient to avoid contact with eyes, mouth, mucous membrane, angles of the nose or skin which is broken, abraded or infected, or has eczema. If contact occurs, area should be washed with copious amounts of water
- advise patient to not use gel under occlusive dressing or on a large area

**Eye drops**

- should not be instilled if soft or gas-permeable contact lenses are in situ as many eye drops contain benzalkonium chloride as a preservative, which may cause discolouration of soft contact lenses. Lenses should be removed before instillation and reinserted after at least a 15-minute interval
- advise patient not to use drops if they are cloudy or change colour
- instruct patient in correct technique for instilling eye drops, including:
  - not allowing tip of dispensing container to touch the eye as it may cause injury and/or contaminate the eye drops
  - if the container is new, remove protective seal, otherwise check expiry date
  - wash hands thoroughly with soap and water
  - remove lid/cap and hold container upside down in one hand between thumb and forefinger or index finger
  - using other hand, gently pull down on lower eyelid to form a pouch/pocket and tilt head back, looking up
  - place tip of container close to lower eyelid (taking care not to make contact between tip and eye). Squeezing bottle gently, release one drop into pouch/pocket formed between eye and eyelid
  - gently close eye, but do not blink or rub eye
  - while eye is closed, place index finger against inside corner of eye and press against nose for about 2 minutes (this stops medicine from draining through tear duct into nose and throat)
  - replace lid/cap tightly
  - wash hands again to remove any residue

- warn patient that vision may be blurred for a few minutes after eye drops have been instilled and it is therefore advisable not to drive or use machinery during this time
- patient should be advised to write expiry date on eye drops when opened and not use beyond this date (usually 28 days)

**Suppositories**

- instruct adult patient in correct technique for suppository insertion, including:
  - the need to empty bowel if possible before suppository insertion
  - wash hands with soap and water
  - if suppository feels soft, place it (unwrapped) in the fridge or hold it under cold water to firm it up
  - put on disposable glove if wanted
  - remove wrapper from suppository and moisten slightly by dipping in cool water
  - lie on side with knees raised to chest
  - push suppository (blunt end first) gently into rectum, taking care not to break suppository
  - remain lying down for a few minutes to allow suppository to dissolve
  - wash hands thoroughly after insertion
- advise patient not to use bowels for at least 1 hour (if possible) after suppository insertion
- see General Patient teaching and advice (p. xxvii)

**use of these agents during the latter stages of pregnancy may cause closure of the fetal ductus arteriosus, fetal renal impairment, inhibition of platelet aggregation and may delay labour and birth. Therefore, continuous treatment with these agents during the third trimester of pregnancy is generally contraindicated**

**not recommended during labour or delivery**

**not recommended during breastfeeding as some NSAIDs and/or their metabolites are excreted in breastmilk and their actions on the newborn may be unknown**

## ASPIRIN (Aspro Clear, Aspro Clear Extra Strength, Astrix 100, Astrix Tablets, Cardasa, Cardiprin 100, Cartia, Disprin preparations, Solprin, Spren)

**Available forms**

Capsules: 100 mg; Tablets: 100 mg, 300 mg, 320 mg, 500 mg; Tablets (enteric-coated): 100 mg; Tablets (effervescent): 300 mg, 500 mg

**Action**

- see General Actions of NSAIDs (p. 12)
- aspirin is converted to salicylic acid mainly in the GI tract
- absorption is dependent on formulation (e.g. soluble formulation increases rate of absorption)
- irreversibly inhibits COX platelet activity (needed for thromboxane synthesis) resulting in prolonged action. It may take 8–12 days (platelet turnover time) after therapy is stopped to fully recover
- half-life of aspirin is about 20–60 minutes, half-life of salicylate acid is about 6 hours

**Use**

- relief of mild-to-moderate non-visceral pain
- headache, migraine

- acute febrile illnesses (not for children or teenagers)
- dysmenorrhoea
- rheumatic pain, including juvenile rheumatoid arthritis
- inflammation associated with back or muscular pain/strain
- cold and flu symptoms
- toothache
- antiplatelet therapy (only on medical advice) for prophylaxis against myocardial infarction, unstable angina, transient ischaemic attacks (TIAs) and stroke

### Dose

- (analgesic, antipyretic) 300–1000 mg orally with food 4–6-hourly as required (up to 4 g/day) **OR**
- (effervescent tablets) 300–1000 mg orally dissolved in 1/2 glass of water 4-hourly as required (up to 4 g/day) **OR**
- (antiplatelet) 100 mg daily

### Adverse effects

- increase in respiratory rate
- (very high salicylate level) depresses respiration
- (prolonged therapy, high dose) hypoprothrombinaemia
- see General Adverse effects of NSAIDs (p. 12)

### Interactions

- may increase blood levels of sodium valproate and methotrexate, increasing risk of toxicity and/or adverse effects
- caution if used with anticoagulants due to increased risk of bleeding
- action of probenecid may be reduced if given with aspirin
- hypoglycaemic action of sulfonylureas may be increased if given with high-dose aspirin; therefore blood glucose levels should be closely monitored
- excretion is increased if given with urinary alkalinisers
- rate and extent of absorption is increased by caffeine
- hydrocortisone may increase metabolism and/or clearance of aspirin. Further, when hydrocortisone is ceased, blood levels of aspirin may rise significantly, increasing risk of adverse effects and/or toxicity
- increased risk of gastrointestinal bleeding if aspirin is given with high dose corticosteroids
- may interfere with a number of laboratory tests, including measurement of heparin activity and urinary glucose oxidase test in the presence of glycosuria

### Nursing points/Cautions

- see General Nursing points/Cautions for NSAIDs (p. 13)
- soluble, effervescent, buffered and enteric-coated salicylate preparations reduce gastric irritation
- enteric-coated and sustained-action preparations have delayed absorption, which is useful for regular long-term therapy
- elderly patients are at greater risk of adverse effects, including tinnitus, nausea, anorexia and gastric irritation
- tinnitus (with normal hearing) is a reliable index of therapeutic plasma level, but may not be detected in patients with hearing loss
- therapy should be stopped 1 week before scheduled surgery
- symptoms of salicylism (chronic salicylate intoxication) are hyperventilation, tremor, papilloedema, agitation, paranoia, bizarre behaviour, memory deficits, confusion and stupor, and, rarely, pulmonary oedema, seizures and renal failure
- symptoms of acute salicylate poisoning include nausea, vomiting, tinnitus, hearing loss, sweating and hyperventilation, followed by mixed acid–base disturbance of respiratory alkalosis

and metabolic acidosis. Uncommonly, fever, neurological dysfunction, renal failure, acute lung injury (non-cardiogenic pulmonary oedema), cardiac dysrhythmias and hypoglycaemia may occur. Rarely, other complications include rhabdomyolysis, gastric perforation and GI haemorrhage

- there is no specific antidote for salicylate toxicity. Treatment of acute salicylate poisoning involves stabilisation of airway, breathing and circulation, correction of volume depletion and metabolic disturbance, GI decontamination and reduction in levels of salicylate. This involves:
  - gastric lavage, followed by single dose of activated charcoal/sorbitol (whole bowel irrigation may be necessary if overdose involves large amounts of enteric-coated or modified-release tablets)
  - assessment of patient's volume and electrolytes. Volume replacement is usually with normal saline with potassium supplementation, as hypokalaemia is common
  - urine alkalisation with IV sodium bicarbonate is more effective than forced diuresis or forced alkaline diuresis
  - urine output should be 1–2 mL/kg/hour
  - serum salicylate and electrolytes should be monitored 1–2-hourly
  - if condition worsens, haemodialysis, peritoneal dialysis or exchange transfusion may be necessary
- not recommended in infants, children and adolescents, including for the treatment of fever and/or muscle pain associated with febrile, viral illness because of the association with Reye's syndrome (see Glossary)

### Patient teaching and advice

- see General Patient teaching and advice for NSAIDs (p. 14)
- stopping aspirin for any reason (e.g. donation of blood) should be discussed with doctor before discontinuing therapy
- effervescent and soluble preparations should be dissolved in ½–1 glass of water for more rapid absorption
- warn patients that sustained-release and enteric-coated preparations should be swallowed whole and not crushed or broken
- advise patient to avoid aspirin within 30 minutes of alcohol
- instruct patient to discuss the need to stop before any surgical procedure with the surgeon
- blood donors should be advised not to take aspirin in the week preceding the donation
- if patient is on a low-sodium diet, he/she should be cautioned that effervescent preparations contain sodium



**enteric-coated tablets/capsules should not be crushed. Tablets are available in dispersible form**

### Note

- contained in Alka-Seltzer, Aspalgin, Clopidogrel/Aspirin 75/100 Tablets, Clopidogrel Winthrop Plus Aspirin, CoPlavix, Diasp SR, DuoCover, Duo-Plidogrel, Dipyridamole/Aspirin, Piax-Plus Aspirin

## BENZYDAMINE (Difflam Anti-inflammatory Gel, Difflam Sore Throat Gargle and Mouth Solution, Difflam Sore Throat Spray, Difflam Sore Throat Spray Forte)

### Available forms

Throat spray: 1.5 mg/mL, 3 mg/mL; Gel: 3%, 5%; Solution: 22.5 mg/15 mL

### Action

- analgesic, anti-inflammatory
- chemically unrelated to other NSAIDs