

## Principles of Drug Administration

- Nurses play an essential role in the drug administration. Preparing and administering the prescribed drug to the patients is a fundamental responsibility of the nurse in many health care settings.
- Nurses are both ethically and legally responsible for correct drugs administration and unacceptable for nurse to administer a drug that is harmful to the patient
- For safe and accurate drug administration, nurses should use the “**Six Rights**” and their subsequent additions and **Three checks** as guidelines.
- The nurse has an important role to protect the patient against the medication errors.

**Medication Orders** – physician’s order should include: The full name of the patient; name of the drug (preferably the generic); the dose, route, and frequency of administration; and the date, time, and signature of the prescriber, usually a physician. Most orders are handwritten on an order sheet in the patient’s medical record or typed into a computer. Occasionally, verbal or telephone orders are acceptable – when taken, they should be written on the patient’s order sheet, signed by the person taking the order, and later countersigned by the prescriber.

After the order written, a copy sent to the pharmacy, where the order recorded and the drug dispensed to the appropriate patient care unit.

★For drugs to be taken at home, written prescriptions are given

**Medication Errors:** is any occurrence (preventable event) that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of healthcare professional, patient, or consumer.

Medication errors are a major problem in health care today – major cause of morbidity and mortality.

Because nurse is the last person who checks medications prior to administration, therefore the nurse responsible to detect and protect the patient against the mistakes made by other member of health care team. For example, the prescriber may overlook potential drug interactions, or may be unaware of alterations in the patient’s status that would preclude use of a particular drug, or may select the correct drug but may order an inappropriate dosage or route of administration.

Medication errors may occur during any phase of drug therapy, including:

- When the drug is prescribing – in transcribing drug orders (write down)
- When the drug is dispensing – drug supply
- In administration of the drug

**Types of Medication Errors:** Medication errors fall into 13 major categories. Some types of errors cause harm directly, and some cause harm indirectly. For example, giving an excessive dose can cause direct harm from dangerous toxic effects. Conversely, giving too little medication can lead to indirect harm through failure to adequately treat an illness.

1. Wrong patient
2. Wrong drug
3. Wrong route
4. Wrong time
5. Wrong dose
6. Omitted dose
7. Wrong dosage form
8. Wrong diluent
9. Wrong strength/concentration
10. Wrong infusion rate
11. Wrong technique (includes inappropriate crushing of tablets)
12. Deteriorated drug error (dispensing a drug after its expiration date)
13. Wrong duration of treatment (continuing too long or stopping too soon)

### **Source of medication errors**

★★Prescribers      ★★Pharmacist      ★★Nurses      ★★Drugs manufacturers  
★★Consumer/patients and their families      ★★Circumstances

### **Causes of medication errors among Nurses include:**

- When one or more of the “**Six Rights**” and **three checks** of drug administration has not been followed. Each time a drug is prepared and administered, these guide lines must be a part of the procedure.
- When have inadequate knowledge about a drug or about the patient receiving the drug.
- Fail to question the medication order when indicated.
- Giving medications based on verbal orders or phone orders, which may be misinterpreted or go undocumented. The nurse should be sure that the medication orders are written before the drug administration.
- Nurses may have a heavy workload, with resultant rushing of administering medications. They may also experience distractions by interruptions, noise, and other events in the work environment that make it difficult to pay needed attention to the medication-related task.

## **The responsibility of nurses regarding Medication Errors**

**Prevention:** Detect and protect the patient against the drug errors – The nurse is the patient's last line of defense against medication errors made by others—and the last person with the opportunity to introduce an error.

**Reporting:** When errors occur, they must be reported immediately as soon as they are noticed. Nurses are legally and ethically responsible for reporting occurrence of medication errors in the patient's medical record and on an incident report – whether or not they cause harm to a patient

**Informing or Notifying:** Inform the primary care providers

**Performing:**

- any necessary steps to counteract the action of the drug .
- any observation can be made as soon as possible.

## **General principles of drug administration to prevent medication errors:**

- ~ Concentrate on one task at each time.
- ~ Seek information about the client's medical diagnosis and condition in relation to drug administration
- ~ Understand the prescriber's order accurately. If the nurse cannot read the physician's order or if the order seems incorrect, he or she must question the order before giving the drug. For safer drug administration, the use of abbreviations for drug names, doses, routes of administration, and times of administration should be minimized – because errors occurring with incorrect or misinterpreted abbreviations.
- ~ Never giving any medications based on verbal orders or phone orders, which may be misinterpreted or go undocumented. The nurse should remind the prescriber that medication orders must be in writing before the drug can be administered.
- ~ Never give a drug poured or prepared by someone else.
- ~ Omit or delay drug doses as indicated by the client's condition; and then reporting or recording omitted drug dose appropriately in the patient's order sheet.
- ~ Learn essential information about each drug to be given.
- ~ Follow the "Six Rights" and three checks as guidelines for safe drug administration.

★★Despite all attempts to provide safe drug delivery, and the nurse follows the six rights of drug administration, **medication errors continue to occur**, some of which are fatal. (Why)

Although the nurse is responsible for safe drug administration, but the safe and accurate drug administration is a result of multidisciplinary actions.

There are multiple individuals (health care providers) and several steps involved in getting each dose of a medication to the intended patient.

## Drug Formulations and dosage forms

**Pharmaceutical Formulation:** صياغة المستحضرات الصيدلانية

It is the method by which a drug is prepared – the process in which different chemical substances, including the active drug, are combined to produce a final medicine product.

**Dosage Form** شكل الجرعة: It is the form in which the above formulation can be administered to a patient. e.g. as tablet, capsule, syrup or injection ...etc.

**Drug Formulation and dosage forms vary according to the:**

- 1) Drug's chemical and physical characteristics,
- 2) Reason for use, and
- 3) Route of drug administration.

Some drugs are available in only one dosage form; others are available in multiple dosage forms — choosing a form that is best received by the patient will lead to a better total outcome.

Most of drugs can be administered by a variety of routes – Major routes of drug administration include:

- 1) **Enteral,**
- 2) **Parenteral, and**
- 3) **Topical**

These are the common routes of drug administration used in nursing practice.

**Additional methods of administration:** These methods are used by physicians and in some cases by advanced practice registered nurses for medication administration.

- Intra-lesional (into a lesion)
- Intra-theal (instilling drugs directly into CSF) or intra-spinal
- Intra-cardiac (into the heart)
- Intra-pleural
- Intra-arterial (administration is not by direct arterial injection but by means of a catheter that has been placed in an artery)
- Intra-articular (into a joint)

**Factors that determine the choice of drug administration routes, include:**

- 1) Physical and chemical properties of the drug (drug characteristics).
- 2) The dosage form in which the drug is available
- 3) Site of desired action, systemic or local effects
- 4) Rate and extent of absorption of the drug from different routes
- 5) Effect of digestive juices and first pass metabolism on the drug.
- 6) Rabidity with which the response is desired – onset of action (routine treatment or emergency).
- 7) Accuracy of dosage required (I.V. & inhalation can provide fine-tuning).

- 8) The patient's age and condition – unconscious, vomiting, etc. (Patient related factors or patient characteristics)

## Enteral Routes of drug administration

The enteral route – Oral drug administration (PO) includes drugs given by mouth and swallowed – designed to pass through the gastrointestinal tract. It is the oldest and most common route

Advantages	Disadvantages
<ul style="list-style-type: none"><li>- Easy and Convenient</li><li>- Non-invasive, and often painless</li><li>- Potentially reversible, and hence safer than parenteral routes – no risk of fluid overload, infection, or embolism</li><li>- Ideal for self-medication - does not need assistance</li><li>- Mostly inexpensive</li></ul>	<ul style="list-style-type: none"><li>- Variability: absorption can be highly variable from one patient to another → may be slow or irregular</li><li>- Inactivation of some drugs by gastric acid and digestive enzymes</li><li>- Possible nausea and vomiting from local irritation</li><li>- Patient must be conscious and cooperative not suitable for emergency.</li></ul>

## Pharmaceutical preparations for oral administration

A wide range of oral preparations is available – Drugs given orally either in

**Liquid dosage forms** (include syrups, elixirs, emulsions and suspension or mixtures, oral spray...etc. OR **Solid dosage forms** (include tablet, capsule, lozenges, powder, enteric-coated or controlled-release tablets and capsules)

**Enteric-coated preparations:** tablets consist of drugs that have been covered with a material designed to dissolve in alkaline environment of the intestine. These preparations are employed for two general purposes:

- (1) to protect drugs from acid and pepsin in the stomach – e.g., *omeprazole*, and
- (2) to protect the stomach from drugs that can cause gastric discomfort – e.g., *aspirin*.

**Important Note:** It is important to not crush enteric-coated tablets because the medication would then be directly exposed to the stomach environment.

**Extended release preparations (XR)** - also called **Controlled-release CR, timed release TR, sustained release SR:** tablets or capsules are designed to dissolve very slowly and have special coatings that control how fast the drug is released from the tablets or capsules into the blood → long duration of action.

These formulations maintain more consistent serum drug levels and most of these formulations are given once or twice daily, which is more convenient and may improve patient compliance.

**Important Note:** Extended release formulations contain high amounts of drug intended to be absorbed slowly and act over a prolonged period of time, so they should never be broken, opened, crushed, or chewed. Such an action allows the full dose to be absorbed immediately and constitutes an overdose and toxicity .

### **Sublingual or buccal route**

The tablet or pellet containing the drug is not swallowed but kept in the mouth – sublingually (under the tongue) and buccally (held between the gum and the cheek) and must be specifically formulated for such use (Lipid soluble and non-irritating drugs ).

**Advantages:** Drugs administered through these routes act quickly (action can be produced in minutes) because of the oral mucosa's thin epithelium and large vascular system, which allow the drug absorbed directly into systemic circulation and not subjected to destructive digestive enzymes, or undergo hepatic first-pass metabolism. e.g., nitroglycerin for angina pectoris (anti-anginal).

**Disadvantages:** irritation of oral mucosa and excessive salivation promote tablet swallowing. The patient should be instructed not to swallow or move the drug with the tongue, nor to eat or drink anything until the medication has completely dissolved.

### **Parenteral Routes**

Parenteral: introduction of drugs by any route other than the oral (enteral) or topical routes, usually refers to administration of drugs by injection. This route takes the drug directly into the tissue fluid or blood. **Intramuscular (I.M), Intravenous (I.V), Intradermal (I.D), and Subcutaneous (S.C or SQ)**

#### **Advantages of parenteral routes:**

- 1) Provides a rapid onset of action (Drug action is faster – emergencies).
- 2) Used for drugs with poor absorption from intestine
- 3) Can be used for unstable or seriously ill patients, unconscious, uncooperative, vomiting patient.
- 4) Not cause gastric irritation and vomiting.
- 5) No chances of interference by food or digestive juices.
- 6) Liver is bypassed – first pass effect

#### **Disadvantages of parenteral routes:**

- 1) The preparation has to be sterilized.
- 2) The technique is invasive and painful.
- 3) It needs assistance of another person (though self-injection is possible – insulin).
- 4) There is chance of local tissue injury.

In general, parenteral route is more risky than oral (enteral) route



**Intramuscular (I.M):** drug is injected deep in one of the large skeletal muscle, where it absorbed through many bl. vessels.

**Advantages:** Permits use of poorly soluble drugs and depot preparations

**Disadvantages:**

- Painful and Inconvenient route
- Potential for injury –there are risks of damage to blood vessels or nerves if needle is not positioned correctly.

**Intravenous (I.V):** The drug is injected directly into superficial veins and has to be administered by a trained person.

**Advantages**

- 1) Rapid onset, and hence ideal for emergencies
- 2) Permits use of large drug volumes
- 3) The dose of drug required is smallest (bioavailability 100%)
- 4) Used with poorly absorbed drugs from GIT and irritant drugs

**Disadvantages**

- 1) Expensive, Irreversible, and Inconvenient route
- 2) Drug must be water soluble (Only aqueous solutions)
- 3) Difficult to do, and hence poorly suited for self-administration
- 4) Most risky route with many adverse effects and complication

**Subcutaneous (S.C):** Drug injected into the adipose tissues.

**Advantage:** Self- administration. E.g., Insulin & heparin

**Disadvantage:**

- 1) S.C route is discomfort and inconvenience
- 2) commonly used for only a few drugs because many drugs are irritating to SC tissues (cause pain, necrosis & abscess formation).
- 3) Absorption is slower than I.M (tissues is less vascular ).
- 4) Only small volumes can be injected S.C – up to 1 ml.
- 5) This route should be avoided in shock patients who are vasoconstricted→ absorption will be delay.

**Intradermal injection (I.D):** The drug is injected into the dermis layer of the skin. This route is employed for specific purpose only.

It is an important route for local anesthesia, BCG vaccine and Sensitivity testing (e.g., the tuberculin test or allergy skin testing).

**Advantage:** Absorption is slow and allows for good results when testing for allergies or administering local anesthetics.

**Disadvantage:** The amount of the drugs must be small. Breaks the skin barrier.

## **Topical Drug Administration – Dermat mucosal route**

Topical drugs are those applied locally to the skin or the membranous linings of the eye, ear, nose, respiratory tract, urinary tract, vagina, and rectum in the form of lotion, ointment, cream, powder, paints, drops, spray, suppositories or pessaries, (including transdermal patches).

It is often more convenient as well as encouraging to the patient.

Many drugs are applied topically to produce a local and systemic effects.

With either type of topical agent, drugs should not be applied to abraded or denuded skin, unless directed to do so.

**Transdermal Delivery System:** The use of transdermal skin patches. Drugs are readily absorbed from the skin to provide systemic effects and bypass digestive enzymes and first-pass effect in the liver e.g., nitroglycerin for angina pectoris and scopolamine for motion sickness...

This type of drug system are slowly absorbed from the skin and maintains a relatively constant blood concentration. Thus administration is less frequent than when the drugs are given by another route.

In addition, this drug system causes fewer adverse reactions and reduces the possibility of toxicity

## **Inhalation Routes**

This route is particularly effective and convenient for patients with respiratory complaints (such as asthma or chronic obstructive pulmonary disease), because the drug is delivered directly to the site of action, thereby minimizing systemic side effects. E.g., bronchodilators, such as albuterol, and corticosteroids, such as fluticasone.

This route also can be used for systemic effect, e.g. general anesthesia.

## **Homework: Define the following dosage forms**

- Suspension , Emulsion, Elixir, Syrup, Solution, Capsules, Tablets, Lozenge
- lotion, ointment, cream, powder, paints, drops, spray, suppositories or pessaries, transdermal patches