Factors Influencing the Route of Administration

- Drugs are contained in dosing units called formulations or dosage forms.
- A route of administration is a way of getting a drug onto or into the body.

- It's classified into two categories:
  - ENTERAL
  - PARENTERAL
Factors Influencing the Route of Administration

- ENTERAL: refers to anything involving the stomach from the mouth to the rectum.
- PARENTERAL: Routes other than enteral

Drugs come in many different forms and many factors determine the choice of route of administration.

Chapter Outline

- Enteral Formulations
  - Oral (PO)
  - Sublingual (SL)
  - Buccal
  - Rectal (PR)
Chapter Outline

- Parenteral Formulations
  - Intravenous (IV)
  - Intramuscular (IM)
  - Ophthalmic
  - Intranasal
  - Inhalation
  - Dermal
  - Vaginal

Factor Affecting Selection of Route and Method of Administration

1. Drug Characteristics
2. Ease of administration
3. Site of action
4. Onset of action
5. Duration of action
6. Quantity of drug administered
7. Liver or kidney diseases
1. Drug Characteristics

- **The pH scale** measures the acidity or the alkalinity of a substance.
  - pH 7 is neutral (water).
- Stomach is very acidic (pH 1-2).
- Certain drugs are **degraded** or destroyed by stomach acid.
- The **absorption** of many drugs is affected by the presence of food in the stomach.

1. Drug Characteristics

- Stomach is very acidic (pH 1-2).
- Duodenal pH is higher, i.e. closer to neutral
- Colonic pH is neutral to slightly alkaline
1. Drug Characteristics

- In the drug research process the influence of drug characteristics is examined and the formulations approved will have compensated for this.

2. Ease of Administration

- Prescribers assess patient characteristics to determine route of administration.
  - Difficulty in swallowing?
  - Very young or older adult patients might have difficulty swallowing.
  - Consider liquid dose forms or non-oral routes of administration.
  - PO route may be inadvisable for patients with nausea and vomiting.
3. Site of Action

- Route of administration may be influenced by desired site of action.
- **A Local Effect**: Site of drug activity and site of administration are one in the same (e.g. eyes, ears, nose, skin).
- **A Systemic Effect**: The drug is introduced into the circulatory system by any route of administration and carried by the blood to the site of action.

4. Onset of Action

Onset rate varies with formulation and route of administration.
- Since oral medications for systemic use need to go into solution to exert their effect, solutions or suspensions may work faster than oral tablets or capsules.
4. Onset of Action

- Medications placed under tongue or between cheek and gums work quickly because they bypass stomach and liver and go directly into bloodstream.
- Drugs given IV directly are carried immediately throughout the body.
- Localized therapeutic effects, e.g. those applied to the skin, inhaled into the lungs or instilled into the eye.

5. Duration of Action

- The length of time a drug gives the desired effect or is at the therapeutic level.
- Controlled or extended-release
  - Drug effect lasts longer, e.g. 12 to 24 hours.
5. Duration of Action

- Transdermal patches
  - Delivers small amounts of a drug steadily over many hours or even days.
  - Sustained-duration effect can be achieved by means of intravenous (IV) infusion.
- Injections into the muscle and skin last longer than injections directly into the bloodstream.
6. Quantity of Drug

- Sometimes route of administration is chosen because of the amount of a drug that needs to be given.
- IV infusion is an excellent method for systemic delivery of large quantities of material.
- IV injections and infusions can deliver a higher dose of medication to the target site.
7. Metabolism by the Liver or Excretion by the Kidney

- Liver metabolism breaks down active drug to inactive metabolites for elimination and prevents drug accumulation.

- The first-pass effect is the extent to which a drug is metabolized by the liver before reaching systemic circulation.
  - Influences activity of some drugs.
  - Such drugs have to be given in larger oral doses or by different route to bypass metabolism by the liver.
7. Metabolism by the Liver or Excretion by the Kidney

- Age or disease-related changes in liver or kidney function can cause:
  - Drug accumulation
  - and potential toxicity
- Drug dosage often needs adjustment in the elderly.

7. Metabolism by the Liver or Excretion by the Kidney

- If patients are on multiple potent prescription drugs, there is a risk of a drug-drug interaction.
  - Drug accumulation
  - Toxic blood levels increases
Oral Dosage Forms

• Disintegration
  • The breaking apart of a tablet into smaller pieces.

• Dissolution
  • When the smaller pieces of a disintegrated tablet dissolve in solution.

Active vs. Inactive Ingredients

• **Inactive Ingredients**
  • Include binders, lubricants, fillers, diluents, and disintegrates.
  • Added to help manufacture the formulation and to help the dosage form disintegrate and dissolve when administered.
  • If a drug X is a 50 mg tablet, then the actual weight is going to be more than 50 mg because of the inactive ingredients.
Oral Routes of Administration

- The **most frequently** used route of administration is PO (per os).
- Oral refers to two methods:
  - Applying topically to the mouth for local effect.
  - Swallowing for absorption through the GI tract into systemic circulation.

Solid Oral Dose Forms

Common dose forms for enteral administration are solid formulations.
- Tablets
- Capsules
- Bulk powders
- Rectal formulations
Other Tablet Types

- **Bulk powders**: contain the active drug in a small powder paper or foil envelope. The patient empties the envelope into a glass of water or juice and drinks the contents.
- **Chewable tablets** are flavored and are designed to be chewed.
- **Effervescent tablets** are granular salts that release gas and the active ingredient into solution when placed in water or juice.

Capsules

- A **capsule** is a solid dosage form consisting of a gelatin shell that encloses the drug.
  - usually swallowed whole.
  - tasteless and are easier to swallow than tablets.
Capsules

- Contains powders, granules, liquids, or some combination with one or more active ingredients.
- Flavorings are not common for this dose form.
- **Soft or Soft-gel** are capsules that contain liquid instead of powders inside the gelatin shell.

Buccal Administration

- **Buccal tablets** (and gum) are placed in the buccal pouch
  - Between the cheek and the gum.
  - Dissolved and absorbed by the buccal mucosa.
Oral Dose Forms Modified Release Formulation

- A **delayed-release** dose form does not release the active drug immediately after administration.
- Avoid destruction in the stomach
- Reduce GI upset
- An **extended-release** dose form allows reduced frequency of dosing.
Oral Dose Forms Modified Release Formulation

- Delayed-release medication is **NOT** the same as extended- or controlled-release medication of the same drug.
- Modified-release dose forms should **NOT** be split.

Oral Dose Forms: Other formulations

Also called long-acting, timed-release, and sustained-release dose forms.
- Sustained Release (SR)
- Extended Release (XR, ER)
- Continuous Release (CR)
- Long acting (LA)
Liquid Formulations

- **Solutions**: a clear liquid.
  - A **solvent** is a liquid that can dissolve another substance to form a solution.
  - **Aqueous solution** = water is the solvent.

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Liquid Formulations

- **Suspensions**: are formulations in which the drug is not dissolved in the liquid.
  - Suspensions should be **shaken well** before dispensing or administration.
  - **Syrups** are concentrated solutions of sucrose (sugar) in water and are thicker than water.
Non-aqueous Liquid Formulations

- Solutions that contain solvent other than water.
- **Elixirs** are sweetened liquids that contain alcohol (5-40%).
  - They are less sweet and less effective in masking taste than syrup.
- **Spirits** are alcoholic solutions that contain volatile oils (alcohol 62-85%).
- **Tinctures** are alcoholic solutions (like Spirits) but of nonvolatile substances.

Liquid Formulations - Emulsions

- Liquid Formulations (Emulsions) are solutions of oil and water based substances.
- **Emulsifier** is a substance that disperses the oil in to water (o/w emulsion) or water into oil (w/o emulsion).
- **Creaming** occurs when dispersed droplets merge together; can be dispersed by shaking.
- **Coalescence** is irreversible separation of the dispersed phase.
Liquid Formulations - Gels

- Made using a substance called gelling agents.
  - e.g. Carbopole® 934P, methylcellulose, hydroxypropyl-methyl-cellulose, and sodium carboxy-methyl-cellulose are recommended for oral administration.
- Usually take 12-24 hours to reach maximum viscosity.
- Add the active drug before the gel is formed.

Other Delivery Systems

- **Unit dose disposable syringes** are pre-filled syringes that contain a single pre-measured dose of medication and are thrown away after use.
- An **oral syringe** is a device without a needle to administer medication to pediatric or elderly patients unable to swallow tablets or capsules.
Effervescent Salts and Lozenges

- **Effervescent salts** contain one or more medicinal agents and:
  - Some combination of sodium bicarbonate with citric acid, tartaric acid, or sodium biphosphate.
  - Release carbon dioxide gas when dissolved.
- **Lozenges** contain active ingredients and flavorings that are dissolved in the mouth.
  - Also known as troches or pastilles.
  - Generally have local effects.

Other Delivery Systems

- **Dropper**
  - Contains a small, squeezable bulb at one end and a hollow glass or plastic tube with a tapering point.
  - Frequently incorporated into the cap of a vial or other container.
- **gtt** is the abbreviation for drops.
  - Droppers are often used for otic or ophthalmic administration.
Sublingual Administration

- Designed to be dissolved under the tongue.
- Medication dissolved under the tongue is absorbed very quickly.
- Nitroglycerin (NTG) is the best known example of SL formulation (for chest pain).
- Advise patients to take a sip of water first and not to eat food or beverages until the drug is fully absorbed.

Oral Dose Forms

- **Capsules** are preferred over **tablets** for patients with difficulty swallowing.
- **Water** preferred over beverages to aid in swallowing.
- Some dose forms are designed to be **sprinkled on food** when swallowing a solid is difficult.
- **Liquid doses** are swallowed more easily and are suitable for
  - Patients with swallowing difficulties.
  - Small children.
Advantages of the Oral Route

- Ease and safety of administration.
- Active ingredient is generally contained in powders or granules which dissolve in GI tract.
- Sublingual (and buccal) administration has a rapid onset (less than 5 minutes).

Disadvantages of the Oral Route

- Delayed onset
- Dose form must disintegrate before absorption.
- Destruction or dilution of drug by:
  - GI fluids and acid.
  - Food or drink in stomach or intestines.
- Not indicated in patients who:
  - Have nausea or vomiting.
  - Are comatose, sedated, or unable to swallow.
Disadvantages of the Oral Route

- Unpleasant taste of some liquid dose forms
- Must be masked by flavorings to promote compliance.
- Some drugs given SL or buccally have a short duration of action.
  - NTG less than 30 to 60 minutes.
- Buccal route may have
  - Medicinal taste.
  - Local mouth irritation.

Dispensing Oral Medications

- Patients need instruction on proper storage of nitroglycerin.
- SL nitroglycerin tablets should be stored in their original container (brown glass bottle).
  - Lid screwed on tightly to prevent loss of potency.
- Pillboxes should be discouraged.
- Refill nitroglycerin with a fresh bottle every 6 months.
Rectal Medications- Suppository

- Remove suppository from its package.
- Insert tapered end first with index finger for the full length of the finger.
- May need to be lubricated with a water-soluble gel to ease insertion.
- Refrigeration may make insertion of rectal medications easier in warm climates.

Rectal Formulations

Rectal administration is preferred when:

- An oral drug might be destroyed by acidic fluids in the stomach.
- An oral drug might be too readily metabolized by the liver and eliminated from the body.
- The patient is unconscious and needs medication.
- N &/or V or severe acute illness in the GI tract make patient unable to take oral drugs.
- The site of action is local to the rectum.
Parenteral Routes of Administration

• The term *parenteral* comes from Greek words.
  – *Para* (outside) and *enteron* (the intestine)
• *Parenteral administration* is an injection or infusion by means of a needle or catheter inserted into the body.
• Parenteral forms deserve special attention.
  – Complexity, potential for therapeutic benefit and danger including risk of infection.
• This route of administration bypasses the GI tract.

Parenteral Routes of Administration

<table>
<thead>
<tr>
<th>Injection Independent</th>
<th>Injection Dependent</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ophthalmic</td>
<td>• intravenous</td>
</tr>
<tr>
<td>• intranasal</td>
<td>• intramuscular</td>
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<tr>
<td>• inhalation</td>
<td>• intradermal</td>
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<tr>
<td>• dermal</td>
<td>• subcutaneous</td>
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<tr>
<td>• vaginal</td>
<td>• epidural</td>
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<tr>
<td>• otic</td>
<td>• intrathecal</td>
</tr>
</tbody>
</table>
Parenteral Dosage Routes

- INTRA means INTO
  - Intravenous into the vein (IV)
  - Intradermal into the dermis (skin)
  - Intramuscular into a muscle (IM)
- Subcutaneous injections
  - Under the skin

Parenteral Forms for Injection

- Parenteral preparations must be
  - Sterile
- To ensure sterility, parenterals are prepared using
  - Aseptic techniques
  - Special clothing (gowns, masks, hair net, gloves)
  - Laminar flow hoods placed in special rooms.
Parenteral Dosage Forms

- IV route
  - Directly into a vein
  - Prepared in hospitals and home healthcare pharmacies.
- Antibiotics
- Chemotherapy
- Analgesics
- Nutrition
- Critical care medications

Needle Size Recommendations

<table>
<thead>
<tr>
<th>Route</th>
<th>Gauge Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intravenous (IV)</td>
<td>16 - 20</td>
</tr>
<tr>
<td></td>
<td>1 - 1.5”</td>
</tr>
<tr>
<td>Intramuscular (IM)</td>
<td>19 - 22</td>
</tr>
<tr>
<td></td>
<td>1 - 1.5”</td>
</tr>
<tr>
<td>Subcutaneous (SC)</td>
<td>24 - 32</td>
</tr>
<tr>
<td></td>
<td>3/8 - 1”</td>
</tr>
<tr>
<td>Intradermal (ID)</td>
<td>25 - 32</td>
</tr>
<tr>
<td></td>
<td>3/8”</td>
</tr>
</tbody>
</table>
Parenteral Route

- Disposable syringes and needles are used to administer drugs by injection.
- Different sizes are available depending on the type of medication and injection needed.
- IV infusion can provide a continuous amount of needed medication.
- Without fluctuation in blood levels of other routes.
- Infusion rate can be adjusted.
- Provides more or less medication as the situation dictates.

Intravenous Formulations

- Administered directly into a vein.
- Takes about 20 seconds to circulate throughout the body.
- Aqueous solutions are the most common formulations.
- Syringeability – the ease with which a material can be drawn from container into a syringe.
- Injectibility is the ease of flow when a material is injected into a patient.
Intravenous Injections or Infusions

- Intravenous (IV) injections are injected directly into a vein and are administered at a 15- to 20-degree angle.

Intravenous Administration Devices

- **Infusion**
  - The gradual IV injection of a volume, usually 500 – 1000 ml, of fluid into a patient.
  - E.g. dextrose in water 5% (D5W), 0.9% sodium chloride in water (NS).
  - The solution bag has two ports: an **administration set port** and a **medication port**.
IV Administration Devices

- **Infusion Pump**
  - Ensures consistent and controlled delivery rate.
  - Patient controlled analgesia (PCA) are pumps for self administration or pain medications.

Parenteral Route Advantages

- The IV route is the **fastest method** for delivering systemic drugs.
  - Preferred route in an emergency situation.
  - It can **provide fluids, electrolytes, and nutrition**.
    - Patients who cannot take food or have serious problems with the GI tract.
    - It provides **higher concentration** of drug to bloodstream or tissues.
    - Advantageous in serious bacterial infection.
Parenteral Route Disadvantages

- Formulation is limited to:
  - solutions,
  - suspensions, and
  - Emulsions.
- Has to be **STERILE** (bacteria free).
- **pH** must match body fluid's using buffer system.
- Limited volume should be used to avoid pain and **necrosis**.

---

Parenteral Route Disadvantages

- Higher Cost: drug and auxiliary devices
- Require skilled personnel to administer them.
- Most difficult to remove once administered if there is an adverse or toxic reaction.
- Requires a needle for injection
- Potential for additional adverse events, e.g. infection or clot formation.
### IV Formulation Complications

- Thrombus formation
- Phlebitis
- Air emboli occur when air is introduced into the vein.
- Particulate material can include small pieces of glass that chip from the product's vial or rubber pieces from the stopper.

### Intramuscular Injections

- Care must be taken with deep IM injections to avoid hitting a vein, artery, or nerve.
- In adults, IM injections are given into upper, outer portion of the gluteus maximus.
- For children and some adults, IM injections are given into the deltoid muscles of the shoulders.
- Depot – the area in the muscle where the formulation is injected.
Intramuscular Injections

- Typical needle is 22- to 25-gauge 1- to 1.5-inch needle.
- IM injections are administered at a 90-degree angle.
- Volume limited to less than 3 mL.

Advantages and Disadvantages of the IM Route

- Intramuscular (IM) and subcutaneous routes of administration are convenient ways to deliver medications compared with the IV route.
- Onset of response of the medication may be slower.
- Duration of action can be longer.
- Practical for use outside the hospital.
- Used for drugs which are not active orally.
Advantages and Disadvantages of the IM Route

- For IM administration, the injection site needs to be “prepped.”
  - using alcohol wipe.
- Correct syringe, needle, and technique must be used.
- Rotation of injection sites with long-term use.
- Prevents scarring and other skin changes.
- Can influence drug absorption.

Subcutaneous Injections

- Administer medications below the skin into the subcutaneous fat.
  - Outside of the upper arm.
  - Top of the thigh.
  - Lower portion of each side of the abdomen.
  - Not into grossly adipose, hardened, inflamed, or swollen tissue.
- Often have a longer onset of action and a longer duration of action when compared with IM or IV injection.
Subcutaneous Injections

- Given at a 45-degree angle.
- 24- or 32-gauge needle, 3/8 to 5/8 inch length.
- No more than 1.5 mL should be injected into the site.
- Avoids pressure on sensory nerves causing pain and discomfort.
Subcutaneous Injections Insulin

- Given using 30-32gauge short needles
  - in special syringe that measures in UNITS.
- Keep insulin refrigerated.
- Check expiration dates frequently.
  - Opened vials should be discarded after 28 days.
- A vial of insulin is mixed by rolling between the hands and never be shaken.
- The rubber stopper should be wiped with an alcohol wipe.

Intradermal Injections

- Given into capillary-rich layer just below epidermis for:
  - local anesthesia
  - immunizations
  - diagnostics
**Intradermal Injections**

- Examples of ID injections include:
  - Skin test for tuberculosis (TB)
    - Typical site is the upper forearm, below the area where IV injections are given.
  - Allergy skin testing
    - Small amounts of various allergens are administered to detect allergies.
    - Usually on the back.

**Implants and Plasters**

- **Implants**, or pellets, are dosage forms placed under the skin by means of minor surgery.
  - Used for long-term, controlled release of medications.
  - Enhanced patient compliance & convenience.
  - Complications at the site of insertion have limited use.
  - E.g: Viadur® - Duros® - Supperlin LA®
  - **Plasters** are solid or semisolid preparations that adhere to the body.
Topical Routes of Administration

- Topical administration is the application of a drug directly to the surface of the skin.
- Includes administration of drugs to any mucous membrane:
  - Nose
  - Ears
  - Vagina
  - Urethra
  - Colon
  - Lungs

Ophthalmic Medications

- Are administered for local treatment.
- Must be at room temperature or body temperature before application.
- Have to be sterile. Only preparations with preservatives can be repeatedly used.
**Ophthalmic Medications**

- A major problem
  - The immediate loss of a dose by natural spillage from the eye.
  - About 80% of a dose will be lost from the eye by overflow.
  - Unused ophthalmic medications should be discarded 30 days after the container is opened.
  - Manufacturer expirations do not apply once a patient has opened the medication.

**Ophthalmic Ointments Formulation**

- Tend to keep the drug in contact with the eye LONGER than solutions.
- Most ointments are made of mineral oil and white petroleum and have a melting point close to body temperature.
- Ointments cause blurring of vision and should be applied at night.
Ophthalmic Administration

- Before application, patient should wash hands.
- Prevents contamination of application site.
- Tube or dropper should not touch the application site.
- Medication may become contaminated.

Ophthalmic Administration

- Only sterile ophthalmic solutions or suspensions should be used in the eye.
- Ear drops can NEVER be used in the eye, but eye drops CAN be used in the ear.
Ophthalmic Administration

- Patient’s head should be tilted back.
- After administration, the patient should place a finger in the corner of the eye, next to the nose to close the lacrimal gently.
- Prevents loss of medication through tear duct.
- Patient should also keep the eyes closed for 1 or 2 minutes after application.

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Ophthalmic Administration

- When multiple drops of more than one medication are to be administered, the patient should wait 5 minutes between different medications.
- The first drop may be washed away.
- If an ointment and a drop are used together, the drop is used first.
- Wait 10 minutes before applying the ointment.
Contact Lenses & Ocular Inserts

- **Contact lenses**
  - If the patient is allowed to wear contact lenses, the lens should be put in the eye 5 minutes *after* the solution is used.

- **Ocular Inserts**
  - Ocusert® is an ocular insert designed to deliver pilocarpine at a controlled rate for up to 7 days.
  - Lenses placed in a solution containing a drug and the lenses absorb the drug solution.

Intranasal Formulations

- Nasal cavity holds about 20 ml and has a very rich blood supply.
- May reach drug concentration similar when a drug is administered as IV.
- Nasal inhaler is a cylindrical tube with a cup that contains fibrous material impregnated with a volatile drug.
Intranasal Formulations

- Applied by:
  - drops (instillation)
  - sprays
  - aerosol (spray under pressure)
- Used for:
  - relief of nasal congestion or allergy symptoms
  - administration of flu vaccine

Intranasal Formulation

- Patient should:
  - Tilt head back.
  - Insert dropper or spray or aerosol tip into the nostril pointed toward the eyes.
  - Apply prescribed number of drops or sprays in each nostril.
  - Breathing should be through mouth to avoid sniffing medication into the sinuses.
  - Important not to overuse nasal decongestants.
Orally Inhaled Medications

• Intended to deliver drugs to the lungs.
  • Lungs are designed for exchange of gases from tissues into bloodstream.
  • Usual dose form is an aerosol.
  • “Environmental friendly” propellants now required to replace chlorofluorocarbons (CFCs).

• Avoids the problems of:
  • Degradation found with oral administration.
  • Minimizes potential toxicity associated with systemic administration.
  • Most common examples are medications for respiratory illness including asthma.
Inhaled Medications

- **Metered-dose inhalers (MDI)**
  - Provide medication with compressed gas.
  - Deliver measured dose with each activation.
  - If a MDI contains a steroid, the patient should **RINSE** the mouth thoroughly after dose to prevent oral fungal infection.

Inhaled Medications

- **Nebulizers**
  - Create a mist when a stream of air flows over a liquid.
  - Commonly utilized for young children or elderly patients with asthma or lung disease.

- **A diskus**
  - A newer dosage form to administer drug to lungs as micronized powder.
Inhaled Medications

- Most inhalation dosage forms are MDI aerosols that depend on the power of compressed or liquefied gas to expel the drug from a container.
- **Particle size** of the aerosolized medication is a critical factor with MDIs.

Inhaled Medications

- **Spacer and adapters**
  - MDI requires coordination between breathing in and activation of the aerosol.
  - There are extension devices to assist the patient who can't coordinate these two processes.
Proper Administration of Aerosolized Medications

1. Shake canister well.
2. Insert canister into a mouthpiece and connect to spacer.
3. Breathe out and hold spacer between lips making a seal.
4. Activate MDI and take a deep slow inhalation.
5. Hold breath briefly, and slowly exhale through the nose.

Transdermal

- Delivers drug to bloodstream via absorption through the skin.
- Therapeutic effects can last for up to 1 week.
  - across membranes of the skin.
  - into layer where absorption into bloodstream occurs.
- Transdermal patches should be carefully discarded after use because they could cause serious side effects if ingested by young children or pets.
Basic Rule of Percutaneous Absorption

- More drug is absorbed when the formulation is applied to a larger surface area.
- Formulations or dressings (occlusive) that increase the hydration of the skin generally improve absorption.
- The greater the amount of rubbing in (inunction) of the formulation, the greater the absorption.
- The longer the formulation remains in contact with the skin, the greater will be the absorption.

Topical Dose Forms

- Dose forms for topical administration include:
  - Skin:
    - creams
    - ointments
    - lotions
    - gels
    - transdermal patches
**Ointments, Creams, Lotions, & Gels**

- Dose forms should be applied as directed to the skin.
  - lotions, creams, and gels are worked into the skin.
  - ointments stay on the surface.
- When using some topicals, e.g. nitroglycerin ointment, the patient or caregiver should wear gloves to avoid being dosed with the drug.

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**Ointments, Creams, Lotions, & Gels**

- When using topical corticosteroids:
  - Apply sparingly to affected areas for short periods of time.
  - Affected area should not be covered up with a bandage unless directed by the physician.
    - Occlusive dressings can significantly increase drug absorption and risk of side effects.
  - Overuse of potent topical corticosteroids can lead to serious systemic side effects.
Transdermal Patches

- Site of administration should be rotated and relatively hair free.
- Should not be placed over a large area of scar tissue.

Topical Formulations Advantages

- Local therapeutic effects.
- Lower risk of side effects.
- Not well absorbed into the deeper layers of the skin or mucous membrane.
- Offers steady level of drug in the system.
Vaginal Formulations

• The vaginal route of administration is application of drug via cream or insertion of tablet into the vagina.
• The vaginal route is preferred for:
  • contraception
  • treatment of infections
• Major disadvantages:
  • inconvenience
  • “messiness”

Vaginal Medications

Application should follow a specific technique:
• Begin with an empty bladder and washed hands
• Open the container and place dose in applicator.
• Lubricate applicator with water-soluble lubricant if not pre-lubricated.
• Lie down, spread the legs, open the labia with one hand, and insert the applicator about two inches into the vagina with the other hand.
• Release labia; use free hand to push applicator plunger.
• Withdraw the applicator and wash the hands.
Vaginal Formulations

- **Vaginal tablets** also called inserts, they are inserted in the same manner as vaginal suppositories.
- Patients should be instructed to dip the tablet into water before insertion.
- Patients may want to wear a sanitary napkin to protect nightwear and bed linens.

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Vaginal Formulations

- **Ointments, Creams, and Aerosol Foams**
  - Contain antibiotics, estrogenic hormonal substances, or contraceptive agents.
  - Creams and foams are placed in a special applicator tube, and the tube is then inserted high in the vaginal tract.
Intrauterine Devices (IUDs)

- A device placed in the uterus.
- Have a lower rate of vaginal expulsion due to their similarity to the uterine shape.
- ParaGard® is an IUD that has been shown to be effective for up to 12 years.
- Mirena® is another category of IUDs that is based on the release of the hormone progesterone.

The Vaginal Ring

- A hormone based system used in one month cycles.
- The ring is inserted in the vagina for 3 weeks, removed for 7 days, and then reinserted.
- NuvaRing® is an example of such a device.
### Toxic Shock Syndrome (TSS)

- A rare and potentially fatal disease that results from a severe bacterial infection of the blood.
- Though primarily associated with the use of super absorbency tampons, it has also been associated with various vaginal dosage forms.
- TSS symptoms include a high fever, nausea, skin rash, faintness, and muscle ache. It is treated with antibiotics and other medicines.

### Otic Medications

- Must be at room temperature or body temperature.
- Heated drops may cause rupturing of the eardrum.
- Cold drops can cause vertigo and discomfort.
- Old medication should be removed along with any drainage before applying fresh medication.
- Alcohol causes pain and burning sensation.
- Should not be used if the patient has a ruptured tympanic membrane (eardrum).
Otic Medications

- Tilt head to side with ear facing up for 2 to 5 minutes.
- Cotton balls placed in the ear after administration of drops will prevent excess medication from dripping out of the ear.
  - Balls will not reduce drug absorption.
  - Patients under 3 should have lobes pulled down and back.
  - Patients over 3 should have lobes pulled up and back.

Terms to Remember

1. alveolar sacs (alveoli)
2. aqueous
3. biocompatibility
4. buccal
5. buffer system
6. colloids
7. conjunctiva
8. contraceptive
9. depot
10. diluent
11. disintegration
12. dissolution
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<th>TERMS TO REMEMBER</th>
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<tr>
<td>13. Emulsions</td>
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<td>14. Hydrates</td>
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<td>15. Injectable</td>
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<td>17. Intrauterine device (IUD)</td>
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