Chapter- 15

Suppositories-I

Mr. Abu Tahir
Assistant Professor,
Rajiv Gandhi Institute of Pharmacy,
Faculty of Pharmaceutical Science & Technology,
AKS University Satna, (M.P.)

ABSTRACT

Suppositories are solid dosage forms intended for insertion into body orifices, where they melt, soften, or dissolve to exert local or systemic effects. Commonly used routes include rectal, vaginal, and urethral administration. They are designed to bypass the gastrointestinal tract, making them suitable for patients who cannot take oral medications.

There are several types of suppositories based on their route of administration.
Rectal suppositories are used for local effects, such as relieving hemorrhoids, or systemic effects, such as delivering antipyretics and analgesics.

Vaginal suppositories, also known as pessaries, are used to deliver medications for treating infections, contraception, or hormone replacement therapy.

Urethral suppositories, or bougies, are used less frequently and typically treat local infections or inflammation.

The advantages of suppositories include avoiding first-pass metabolism, making them suitable for drugs that are poorly absorbed or extensively metabolized in the gastrointestinal tract. They provide a viable option for patients who cannot swallow tablets or are experiencing vomiting. Additionally, they can deliver both local and systemic therapeutic effects.

However, suppositories have disadvantages. They can be uncomfortable and inconvenient for some patients, and their use may be limited by patient compliance. The absorption of the drug can be erratic, influenced by factors such as the presence of fecal matter or vaginal discharge. Additionally, storage conditions are critical as suppositories may melt at higher temperatures.

The types of bases used for suppositories include **oleaginous (fatty) bases** and **water-soluble (hydrophilic) bases**. **Oleaginous bases** like cocoa butter and hydrogenated vegetable oils are popular due to their soothing properties and ease of melting at body temperature. **Water-soluble bases**, such as polyethylene glycol (PEG) and glycerinated gelatin, dissolve in bodily fluids and are suitable for drugs requiring a gradual release.

15.1 Introduction

Suppositories are solid dosage forms designed for insertion into body cavities, where they dissolve or melt to release their active ingredients. They are commonly used for local or systemic effects and are particularly useful when oral administration is not feasible. Here's a detailed introduction to suppositories:

1. Definition and Types

- **a.** **Definition**: Suppositories are small, typically cylindrical or torpedo-shaped solid substances intended for insertion into body cavities (rectal, vaginal, or urethral), where they dissolve or melt and release their active ingredients.
- **b.** **Types**:
  - **i.** **Rectal Suppositories**: Inserted into the rectum, used for local treatment (e.g., hemorrhoids) or systemic effects (e.g., fever reduction).
  - **ii.** **Vaginal Suppositories**: Inserted into the vagina, commonly used for local treatment of infections or hormonal therapy.
  - **iii.** **Urethral Suppositories**: Less common, inserted into the urethra, used for conditions like erectile dysfunction.

2. Composition

- **a.** **Base**: The base material holds the active ingredient and facilitates its release. Common bases include:
  - **i.** **Fatty Bases**: Such as cocoa butter or hydrogenated vegetable oils, which melt at body temperature.
  - **ii.** **Water-Soluble Bases**: Such as polyethylene glycol (PEG), which dissolve in body fluids.
- **b.** **Active Ingredients**: Drugs or compounds that provide the therapeutic effect, which may include analgesics, anti-inflammatories, or hormones.

3. Mechanism of Action

- **a.** **Local Effect**: Suppositories can provide localized treatment by releasing the active ingredient directly where needed (e.g., treating hemorrhoids with anti-inflammatory drugs).
- **b.** **Systemic Effect**: Active ingredients can be absorbed through the mucous membranes of the rectum or vagina, entering the bloodstream and having a systemic effect (e.g., administering anti-nausea medication).

4. Advantages

- **a.** **Alternative to Oral Administration**: Useful when oral medication is not possible due to vomiting, difficulty swallowing, or gastrointestinal issues.
- **b.** **Localized Treatment**: Allows for targeted treatment with reduced systemic side effects.
- **c.** **Controlled Release**: Some formulations are designed for slow, controlled release of the active ingredient.

5. Disadvantages

- **a.** **Patient Acceptance**: Some patients may be uncomfortable or unwilling to use suppositories.

b. **Variable Absorption**: Absorption can be inconsistent due to varying rectal or vaginal conditions.
c. **Storage**: Suppositories require specific storage conditions to prevent melting or degradation.

6. Preparation and Administration

a. **Preparation**: Involves mixing the active ingredient with the base, shaping the mixture into suppository form, and cooling or hardening it.
b. **Administration**: Requires insertion into the appropriate cavity, which should be done with clean hands and, in some cases, with the aid of a lubricating gel.

7. Clinical Applications

a. **Rectal Suppositories**: Often used for pain relief (e.g., acetaminophen), constipation relief (e.g., glycerin), or anti-nausea (e.g., prochlorperazine).
b. **Vaginal Suppositories**: Used for hormonal therapy (e.g., progesterone), antifungal treatments (e.g., clotrimazole), or local infections.
c. **Urethral Suppositories**: Used for treating erectile dysfunction (e.g., alprostadil).

15.2 Definition of Suppositories

Suppositories are solid, typically cylindrical or bullet-shaped dosage forms designed to be inserted into body cavities where they dissolve or melt at body temperature to release their active ingredients. They are used for both local and systemic therapeutic effects.

Key Characteristics

a. **Form**: Solid, with various shapes including cylindrical, torpedo-like, or bullet forms.
b. **Insertion**: Intended for insertion into body cavities such as the rectum, vagina, or urethra.
c. **Release Mechanism**: Dissolve or melt at body temperature to release the active drug.

Purpose and Usage

a. **Local Effects**: Deliver medication directly to the site of action for conditions like hemorrhoids (rectal) or vaginal infections (vaginal).
b. **Systemic Effects**: Absorb through the mucous membranes into the bloodstream, providing systemic effects such as pain relief or anti-nausea treatment.

Applications

a. **Rectal Suppositories**: Used for treating conditions such as constipation, hemorrhoids, or for systemic effects (e.g., anti-nausea medications).
b. **Vaginal Suppositories**: Commonly used for hormonal treatments, antifungal treatments, or other local therapies.
c. **Urethral Suppositories**: Less common, used for conditions like erectile dysfunction.

15.3 Types of Suppositories

Suppositories are categorized based on their intended use and the body cavity into which they are inserted. The main types are rectal, vaginal, and urethral suppositories. Here's a detailed overview of each type:

1. Rectal Suppositories

a. **Purpose**:
   i. **Local Treatment**: For conditions like hemorrhoids or rectal inflammation.
   ii. **Systemic Treatment**: For delivering medications that need to be absorbed into the bloodstream, such as anti-nausea or fever-reducing drugs.

b. **Examples**:
   i. **Anti-Inflammatory**: Hydrocortisone suppositories for inflammation.
   ii. **Laxatives**: Glycerin or bisacodyl suppositories for constipation relief.
   iii. **Anti-Nausea**: Prochlorperazine suppositories for nausea and vomiting.

c. **Advantages**:
   i. Bypasses the gastrointestinal tract, which can be useful if oral administration is not possible (e.g., vomiting, swallowing difficulties).
   ii. Provides a localized effect directly where it is needed.

d. **Considerations**:
   i. Absorption can be variable based on the rectal environment and blood flow.
   ii. Patient comfort and acceptance can be an issue.

2. Vaginal Suppositories

a. **Purpose**:
   i. **Local Treatment**: For conditions affecting the vagina, such as infections or hormonal imbalances.
   ii. **Systemic Treatment**: Some hormonal treatments are absorbed through the vaginal mucosa and have systemic effects.

b. **Examples**:
   i. **Antifungal**: Clotrimazole or miconazole suppositories for treating yeast infections.
   ii. **Hormonal Therapy**: Progesterone suppositories for hormone replacement therapy.
   iii. **Antiseptics**: Used for bacterial infections or post-surgical care.

c. **Advantages**:
   i. Provides localized treatment to the vaginal area.
   ii. Some medications can have systemic absorption through the vaginal mucosa.

d. **Considerations**:
   i. Proper insertion technique is important to ensure effectiveness.
   ii. Some patients may find them uncomfortable or may have difficulty with insertion.

3. Urethral Suppositories

a. **Purpose**:
   i. **Local Treatment**: Primarily used for conditions affecting the urethra or bladder.
   ii. **Systemic Treatment**: Mainly used for erectile dysfunction, where the active ingredient is absorbed into the bloodstream.

b. **Examples**:
   i. **Erectile Dysfunction**: Alprostadil suppositories used to treat erectile dysfunction by increasing blood flow to the penis.

c. **Advantages**:
   i. Provides direct treatment to the urethra.
   ii. Can be an alternative to injections for certain conditions.
d. **Considerations**:
   i. May be less common and less familiar to patients.
   ii. Requires careful handling and insertion to avoid irritation.

Advantages of Suppositories

Suppositories offer several benefits as a dosage form, making them a valuable option in various therapeutic situations. Here's a detailed look at the advantages:

1. Alternative to Oral Administration

a. **Unconscious or Non-Oral Patients**: Suitable for patients who are unable to swallow tablets or capsules due to unconsciousness, nausea, or vomiting.
b. **Swallowing Difficulties**: Helpful for individuals with dysphagia or other conditions that impair their ability to take oral medications.

2. Bypassing the Digestive System

a. **Avoiding Gastric Irritation**: Useful for drugs that may cause stomach upset or irritation if taken orally.
b. **Reduced First-Pass Metabolism**: Rectal suppositories can bypass the liver's first-pass metabolism, potentially increasing the bioavailability of certain drugs. This means more of the drug reaches systemic circulation.

3. Localized Treatment

a. **Targeted Therapy**: Allows for direct treatment of local conditions, such as hemorrhoids, rectal inflammation, or vaginal infections, with minimal systemic side effects.
b. **Enhanced Effectiveness**: Direct application to the affected area can be more effective for certain conditions.

4. Controlled Release

a. **Extended Action**: Some suppositories are formulated to release their active ingredients slowly over time, providing prolonged therapeutic effects.
b. **Reduced Frequency**: Controlled-release formulations can reduce the need for frequent dosing, improving patient compliance.

5. Convenience and Versatility

a. **Alternative Delivery Route**: Provides an option when other routes of administration are not feasible or effective.
b. **Variety of Uses**: Applicable for a range of therapeutic areas, including anti-inflammatory, anti-nausea, analgesic, antifungal, and hormonal treatments.

6. Reduced Systemic Side Effects

a. **Localized Administration**: By delivering medication directly to the target area, suppositories can minimize systemic exposure and reduce the risk of systemic side effects.

7. Special Cases

a. **Children and Infants**: Often used for pediatric patients who may have difficulty taking oral medications or require medications that are unpleasant in taste.
b. **Post-Surgical or Obstetric Care**: Useful in post-surgical or obstetric situations where oral medications are not practical or preferred.

15.4 Disadvantages of Suppositories

While suppositories offer various advantages, they also come with certain drawbacks. Here's a detailed look at the disadvantages:

1. Patient Acceptance and Comfort

a. **Discomfort**: Some patients may find the insertion of suppositories uncomfortable or invasive, leading to reluctance or refusal to use them.
b. **Embarrassment**: The use of suppositories can be socially uncomfortable or embarrassing for some individuals.

2. Variable Absorption

a. **Inconsistent Absorption**: The absorption of medication from suppositories can be inconsistent due to variations in rectal or vaginal environment, such as blood flow, mucus production, or existing conditions.
b. **Limited Drug Choices**: Not all medications are suitable for suppository formulation due to stability or solubility issues.

3. Storage and Stability

a. **Temperature Sensitivity**: Suppositories can be sensitive to temperature changes and may melt or degrade if not stored properly, requiring careful handling and storage.
b. **Short Shelf Life**: Some suppositories have a relatively short shelf life compared to other dosage forms, potentially leading to wastage.

4. Potential Irritation

a. **Local Irritation**: The insertion of suppositories can sometimes cause irritation or discomfort in the rectal or vaginal mucosa, especially with frequent use.
b. **Allergic Reactions**: Some individuals may experience allergic reactions or sensitivity to the base or active ingredients used in suppositories.

5. Technical Challenges

a. **Insertion Technique**: Proper insertion technique is crucial to ensure effectiveness and minimize discomfort. Incorrect insertion can affect the release and absorption of the medication.
b. **Compliance Issues**: Patients may have difficulty with self-administration, particularly if they have mobility or dexterity issues.

6. Limited Use in Certain Conditions

a. **Not Suitable for All Drugs**: Some drugs cannot be effectively formulated into suppositories due to their chemical properties or the potential for interactions with the base material.
b. **Specific Applications**: Suppositories are not always the first choice for systemic treatment and are often reserved for specific conditions where other routes are less effective or feasible.

15.5 Types of Bases of Suppositories

Suppositories require a base to hold the active drug and facilitate its release. The choice of base affects the melting or dissolution characteristics of the suppository and its overall effectiveness. Here's a detailed overview of the types of bases used in suppositories:

1. **Fatty Bases:** Fatty bases are the most commonly used types for suppositories. They are typically made from natural or synthetic fats and oils.
   a. **Cocoa Butter**:
      i. **Properties**: Melts at body temperature (about 34-36°C), allowing the suppository to release its drug as it melts.
      ii. **Advantages**: Non-irritating, widely accepted, and has a smooth texture.
      iii. **Disadvantages**: Can be affected by temperature changes and may have variable melting points.
   b. **Hydrogenated Vegetable Oils**:
      i. **Examples**: Hydrogenated palm oil or soy oil.
      ii. **Properties**: Solid at room temperature but melt at body temperature.
      iii. **Advantages**: More stable than cocoa butter, with consistent melting properties.
      iv. **Disadvantages**: Can be less desirable for patients with allergies to specific vegetable oils.

2. **Water-Soluble or Water-Miscible Bases:** These bases dissolve or disperse in bodily fluids, rather than melting. They are often used for suppositories that need to remain intact until they reach the appropriate location in the body.
   a. **Polyethylene Glycol (PEG)**:
      i. **Properties**: Available in various molecular weights, PEG bases can be tailored to have different melting points and consistencies.
      ii. **Advantages**: Stable, non-greasy, and can be customized for different release rates.
      iii. **Disadvantages**: Can cause irritation in some cases and may not be suitable for all drugs.
   b. **Glycerin**:
      i. **Properties**: A water-soluble base that is often used in combination with other bases.
      ii. **Advantages**: Provides a smooth, slippery texture and helps to draw water into the rectal area, which can be useful for laxative suppositories.
      iii. **Disadvantages**: May cause irritation or discomfort if used alone for certain formulations.

3. **Emulsion Bases:** These bases are blends of fats and water, providing a balance between fat and water-solubility.
   a. **Hydrophilic Ointment**:
      i. **Properties**: Combines water and oil phases, creating a semi-solid consistency.
      ii. **Advantages**: Can provide a controlled release of the active ingredient and can be used for both local and systemic effects.

iii. **Disadvantages**: Can be more complex to prepare and may have variable consistency.

4. **Combination Bases:** Some suppositories use a combination of different bases to optimize properties like melting point, release rate, and stability.
   a. **Mixed Bases**:
      i. **Examples**: Combining fatty bases with PEG or glycerin to achieve desired melting and dissolution characteristics.
      ii. **Advantages**: Tailored to specific drug requirements, balancing stability, and release properties.
      iii. **Disadvantages**: Preparation can be more complex, and the final product may have inconsistent characteristics if not properly formulated.

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