LIQUID DOSAGE FORM

Dr Apurv B Patel

2nd year resident doctor

Department of pharmacology

- Liquid dosage forms, which can be taken by mouth (orally), injected (parenterally), or applied to the skin (locally), have their advantages and disadvantages compared to solid forms like tablets.

Advantages of Liquid Oral Dosage Forms:

- Easier to swallow for children and the elderly.
- Absorbed quickly and work faster.
- Can avoid stomach irritation caused by pills, like in the case of Potassium chloride.

Disadvantages of Liquid Oral Dosage Forms:

- Shorter shelf life.
- May have an unpleasant taste.
- Bulky and inconvenient to store or transport, with a risk of spilling or breaking.
- Doses can be inaccurate.

- Liquid dosage forms contain a combination of ingredients that serve different purposes. Here's a simplified breakdown of the main components:

- **Vehicle**:

  - This dissolves or suspends the drug.

  - Common vehicles include water, syrups, and elixirs.

  - An ideal vehicle should:

- Dissolve as many substances as possible.
- Be chemically inactive (doesn’t react with the drug).
- Have a pleasant flavor (e.g., rose water or peppermint water).
- Provide sweetness.
- Act as a preservative.
- Be affordable.

- Water is often the best vehicle because it meets most of these requirements

Coloring Agents:

- These add **color** to the medicine, making it more appealing to patients.
- Example: caramel (brown).

Sweetening Agents:

- Added to make the medicine **taste** better, especially if the drug is bitter.
- Example: sugar.

Flavoring Agents:

- These mask the bad taste or **smell** of the medicine.
- Common flavors include raspberry and orange syrup.

Types of Liquid Oral Dosage Forms

- **Aqueous Solutions:** These are liquid medicines where one or more drugs are dissolved in water, often with sweeteners, flavors, and colors.

  - **Mixtures:** Liquid medicine for oral use with soluble ingredients (e.g., alkaline mixture).

  - **Syrups:** Sweet, medicated, or flavored liquid to make drugs taste better (e.g., chloroquine syrup).

  - **Linctus:** Thick liquid with soothing agents like **menthol** (e.g., linctus codeine) used for coughs.

- **Drops**: Medicine for babies, given with a dropper for accurate dosing (e.g., multivitamin or iron drops).

- **Elixirs**: Sweetened liquid with **alcohol** and flavor, often used for vitamins (e.g., vitamin B-complex elixir).

- **Suspensions**: A liquid where solid particles (which don't dissolve) are evenly distributed with the help of a suspending agent.

  - **Emulsions**: A mixture of two liquids that don't normally mix (like oil and water). One liquid is broken into tiny droplets and dispersed in the other with the help of an emulsifying agent.

- Each droplet is surrounded by a thin film of emulsifying agent that prevents merging of droplet. (e.g.liquid paraffin emulsion).

- **Advantages**:

  - Allows oily medicines to be taken in liquid form.

  - Oil in tiny droplets is absorbed faster.

  - Emulsifying agents hide the unpleasant taste and smell of oily drugs.

- **Important Note for Suspensions and Emulsions**: These forms need a preservative to prevent bacteria or fungi from growing. Always **shake the bottle well** before taking the prescribed dose.

Fig: Liquid dosage forms with dispenser and dropper

LIQUID PARENTERAL DOSAGE FORMS

- **Injections**: These are sterile liquid medications administered directly into the body.

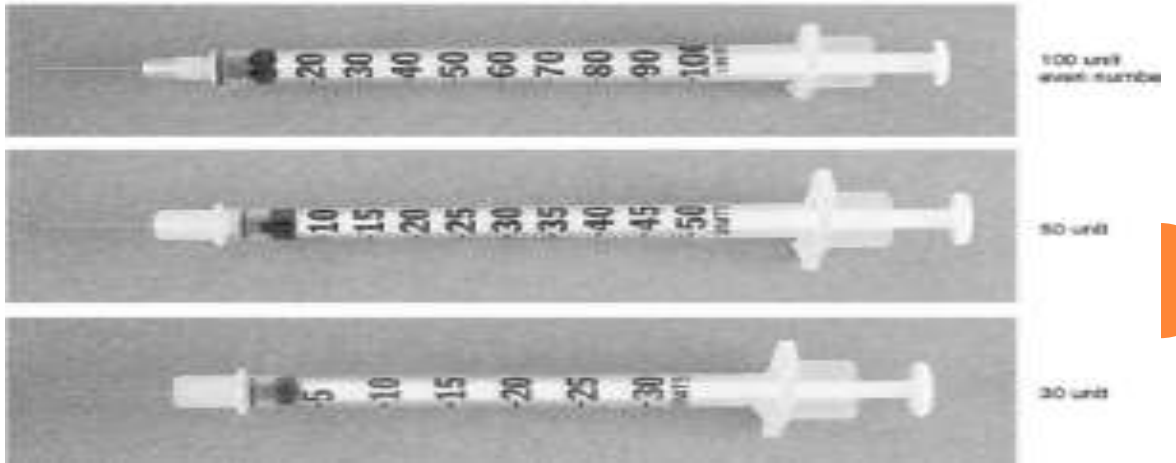
Aspect	Ampoules	Vials
Definition	Small containers holding a single dose of medicine.	Containers that hold either a single or multiple doses of medicine.
Material	Typically made of glass or plastic.	Usually made of glass with a rubber stopper at the top.
Form of Medicine	Contains liquid medicine only.	Can contain either **liquid** or **powder** medicine.
Usage	Must be used **immediately** once opened; leftover medicine is discarded.	Can be used multiple times (if multi-dose), but sterility must be maintained.
Example	**Atropine ampoule** for emergency treatment.	**Vials of vaccines** or **antibiotics** (e.g., penicillin vial).

Equipment for Injections:

Syringes:

- Syringes are used to inject medications. They come in different sizes **(1ml, 2ml, 5ml, etc.)** and are marked for accurate dosing.

- Special syringes are available for insulin or tuberculosis testing, marked in units.



- Made of plastic (disposable) or glass (can be reused after sterilization).
- Syringes with side nozzles are better for intravenous injections.
- Prefilled syringes are designed for single use, like those used for vaccines or immunoglobulins.

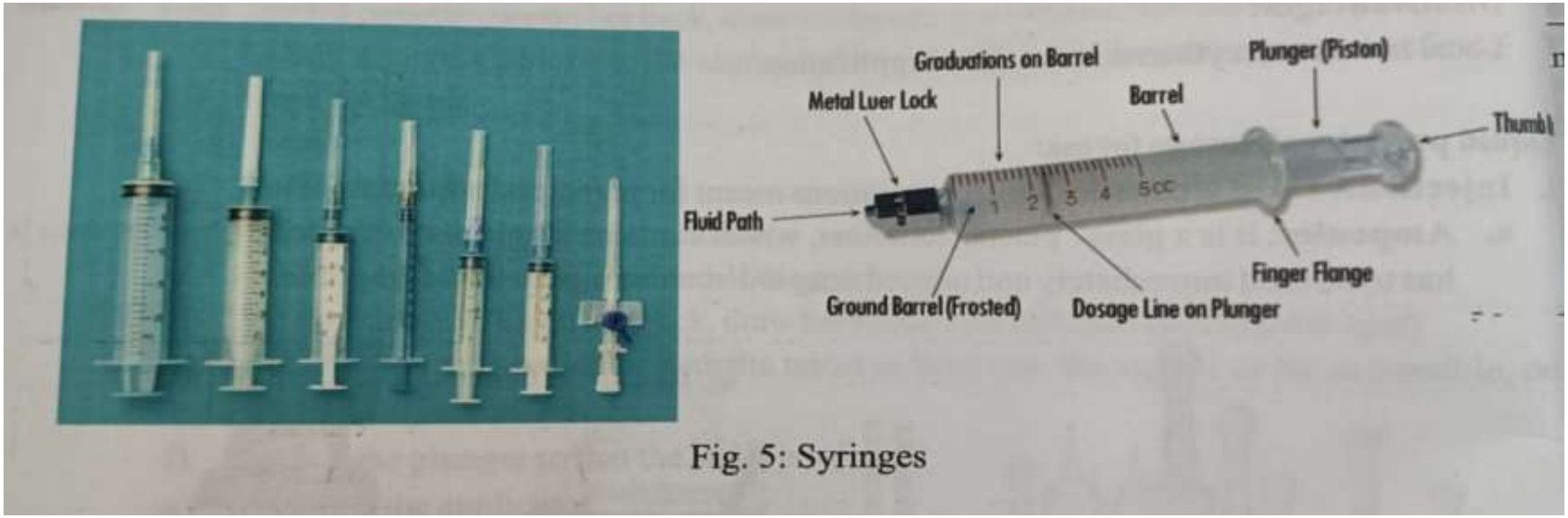
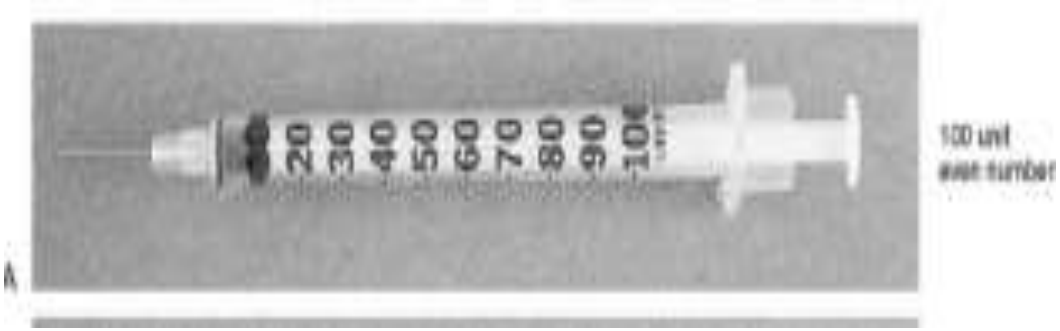


Fig. 5: Syringes

Special syringes

1. Insulin syringe



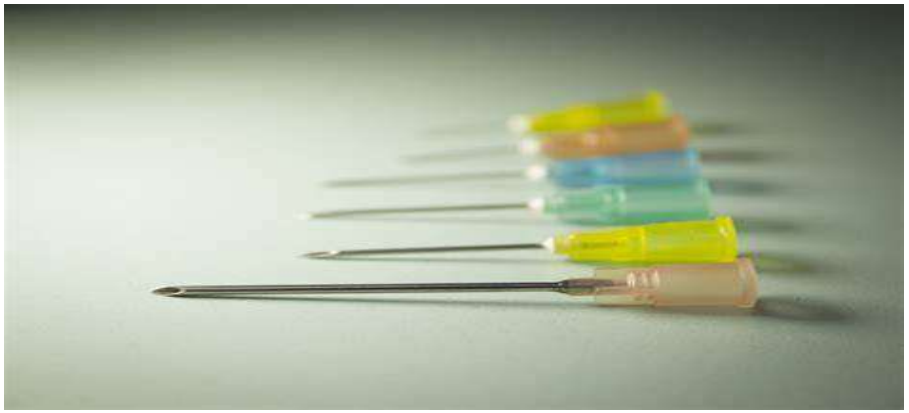
2. Tuberculin syringe

3. Prefilled syringes

4. Loer lock syringe

Needles:

- Needles are metal and attach to the syringe. They come in different sizes based on length and thickness (gauge).
- The thickest needles are 13 gauge, and the finest are 27 gauge.
- Thin needles are used for watery solutions, and thick needles are for oily or thick liquids like penicillin.



Intracath (Catheter for IV Use):

- A plastic tube (catheter) used for intravenous administration, with a metal needle inside.
- After insertion, the needle is removed, and the plastic tube remains in place for 2-3 days.
- **Advantages**: Good for long-term use.
- **Disadvantages**: Risk of infection, irritation (phlebitis), and bruising.

Scalp Vein:

- A small needle used for intravenous access in infants and small children due to their thin skin and minimal fat.

The common parenteral routes with required needles sizes and length are shown below:

Route of administration	Gauge	Length (mm)	Syringe	Site of injection	Drug Examples & Remark
Intra-dermal	26	12	Tuberculin syringe	Anterior & medial surface of forearm	Mantoux test, Allergy testing, BCG vaccination
Subcutaneous or hypodermic	*25*	12	Tuberculin or insulin syringe	Loose subcutaneous tissue of skin, outer surface of arm, front of thigh	Adrenaline, Insulin, Heparin Easy to take, self injection is possible.
Intramuscular	20 22 23 24	37 *25* *25* 16-25	*2-5ml*	Deep between muscle mass, deltoid, dorso -gluteal, ventrogluteal (adults), lateral femoral (children)	Chloroquine, Gentamicin, Diclofenac
Intravenous	20	25-35	10-20 ml, Intracath	Fore arm, anterior cubital or other adjacent veins	Pentothal sodium, Diazepam
Intra-cardiac	14-16	90	10 ml	Through 4th intercostal space into the ventricular chamber	Adrenaline in cardiac arrest
Intra-articular	18-19	35	10 ml	Joint space	Hydrocortisone

Technique for Parenteral Injections

Precautions for Giving Injections:

- **Maintain aseptic conditions**: Ensure everything is clean and sterile.
- **Wash your hands thoroughly** before starting.
- **Clean the injection site** with an antiseptic swab (like methylated spirit).
- **Use sterile, dry equipment**: Syringe and needle must be clean.

- **Apply the correct technique** to reduce pain and avoid injuring nerves or blood vessels.
- **Choose the right size** of syringe and needle based on the injection site.
- **Check the medication**: Confirm the correct drug, strength, expiration date, and ensure it looks fine.
- **Use the correct solvent** for dilution, and don’t mix two drugs unless they are compatible.
- **Do not return unused drug** solution back into the bottle.

- **Aspirate before injecting**: Pull back slightly to check you're not in a blood vessel.
- **Dispose of needle and syringe** safely after use.

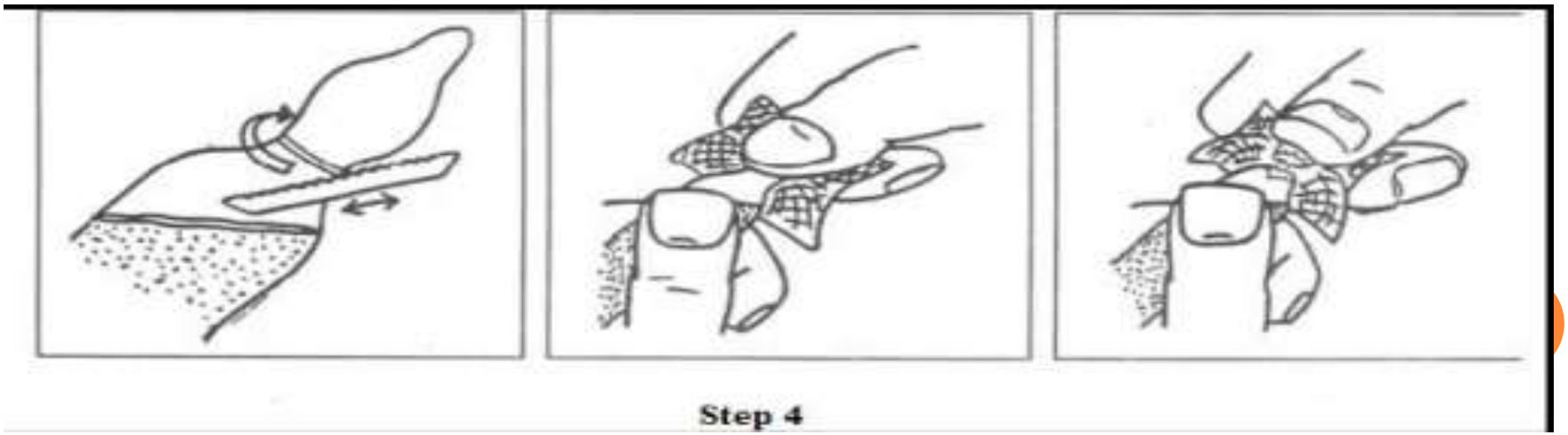
❖ **Important Tip:**

- **Don’t touch the needle shaft** or syringe nozzle.
- **Don’t apply antiseptic** to the needle itself.
- **Avoid giving injections to someone standing**, as it may cause fainting.

How to Withdraw Drug from an Ampoule:

- **Use a sterile, dry, disposable syringe and needle**.
- **Wash your hands** thoroughly and dry them.
- **Attach the needle to the syringe** without touching the tip.
- **Break** off the top using sterile gauze.
- **Tilt the ampoule slightly** to draw out the medicine (do not push air into the ampoule).

- **Withdraw the medication** into the syringe.
- **Remove any air bubbles** from the syringe before injecting.
- **Dispose of the syringe, needle, and broken ampoule** properly.
- **Wash your hands** again after the procedure.



Step 4

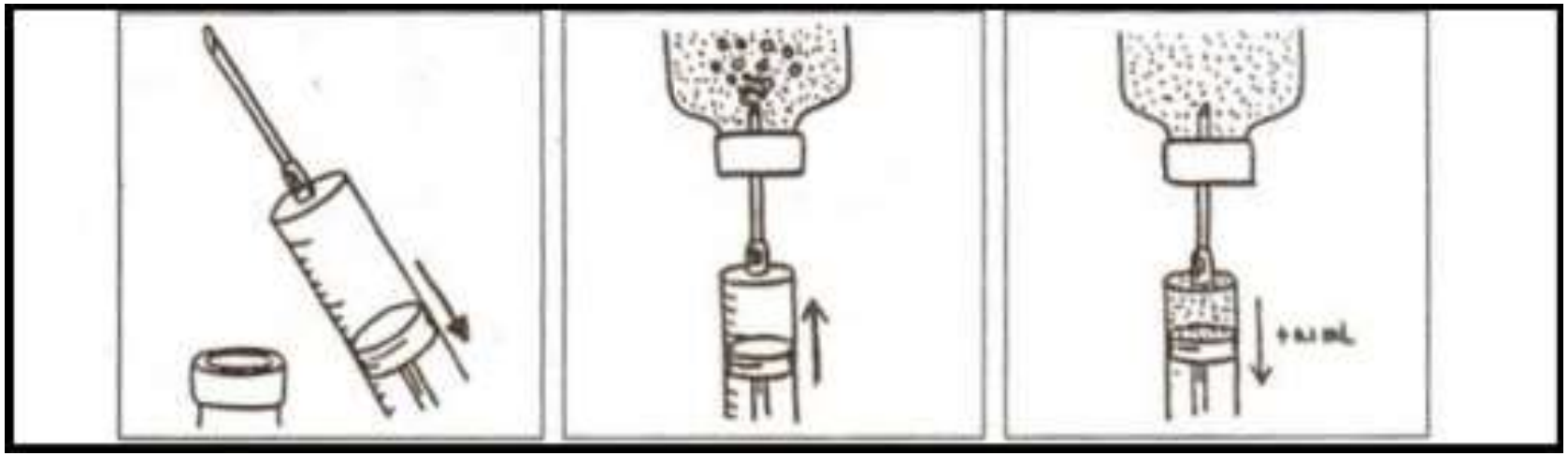
How to Dissolve Dry Medicine in a Vial

- **Wash your hands** thoroughly with soap and water, then dry them.
- **Disinfect the rubber cap** on the vial using an antiseptic swab.
- **Attach the needle** to the syringe and **fill** it with the correct amount of **solvent** (for dissolving the medicine).
- **Insert the needle** into the vial (keeping the vial upright).
- **Inject the solvent** into the vial.
- **Shake the vial** gently to dissolve the medicine completely.

Drug withdrawal from a vial

- **Wash your hands** thoroughly.
- **Disinfect the vial's tip** using an alcohol swab.
- **Use a syringe** with a volume twice the amount of solution needed.
- **Attach the needle** to the syringe, making sure not to touch the needle or syringe tip.
- **Draw air** into the syringe equal to the volume of the drug you need to withdraw.

- **Insert the needle** into the vial's top.
- **Turn the vial upside down.**
- **Inject the air** into the vial.
- **Withdraw the desired amount** of the drug into the syringe.
- **Remove the needle** from the vial.
- **Dispose** of the syringe and needle in a sharps container.
- **Wash your hands** again.



Intravenous (IV) Injection/Infusion

Equipment for IV Infusion:

- An IV set includes:
- **Insertion spike/Plunger**: Used to insert into the infusion bottle.
- **Plastic tube**: For fluid passage.
- **Drip chamber(Murphy's chamber)**: To count drops and control the flow rate.
  - **Macrodrip set**: Delivers 20 drops per ml.
  - **Microdrip set**: Delivers 60 drops per ml.

- **Control clamp/roller/regulator**: To adjust the flow rate.
- **Latex tube**: For injecting additional drugs.
- **Needle adapter**: To attach the needle.

Hazards of Parenteral Administration:

- **Pyrogenic reactions**: Caused by using old solutions.
- **Pulmonary embolism**: Blockage in the lung arteries.
- **Pulmonary edema**: Fluid buildup in the lungs due to rapid infusion.
- **Thrombophlebitis**
- **Extravasation**
- **Circulatory overload**

Method for Intravenous Injection:

- **Wash your hands** with soap and water.
- **Reassure the patient** and explain the procedure.
- **Select a vein** and make it more visible by applying a tourniquet.
- **Disinfect the skin** with antiseptic (spirit).
- **Insert the needle** at a **35-degree** angle with the bevel facing up.

- **Puncture the skin**, then move the needle horizontally into the vein.
- **Aspirate blood** slowly to confirm the needle is in the vein.
- **Loosen the tourniquet** before injecting the drug.
- **Fix the needle** in place with adhesive tape and adjust the flow rate.
- **Check for any pain, swelling, or hematoma**.
- After the infusion, **remove the needle**, press with cotton, and safely dispose of the waste.

INTRAVENOUS (IV) FLUIDS

- IV fluids are solutions administered directly into the bloodstream through an intravenous line. They are available in **glass or plastic containers** with capacities of **100 ml, 500 ml, or 1000 ml**. IV fluids can be categorized into three main groups based on their purpose:

1. Maintenance Fluids

- **Purpose:** To replace fluids lost from the body through normal processes (lungs, skin, urine, and feces).
- **Characteristics:** These fluids are generally low in salt (sodium).
- **Example:** **5% Dextrose (D5W)** - Provides a source of energy while maintaining hydration.

2. Replacement Fluids

- **Purpose:** To correct fluid deficits due to conditions like:
  - **Vomiting**
  - **Diarrhea**
  - **Fluid loss from trauma or burns**

- **Characteristics:** These fluids are typically isotonic, meaning they have similar salt concentrations to the body's fluids.

- **Examples:**
  - **Isotonic Saline (0.9% NaCl)** - Used to replenish lost fluids and electrolytes.
  - **Ringer's Lactate** - Often used for hydration and to restore electrolyte balance.

3. Special Fluids

- **Purpose:** Used for specific medical conditions or imbalances in the body.

- **Indications:** Address particular issues such as:

  - **Hypoglycemia** (low blood sugar)
  - **Hypokalemia** (low potassium levels)

- **Examples:**
  - **25% Dextrose** - Used to treat hypoglycemia.
  - **Inj Potassium Chloride** - Used to correct hypokalemia.

Infusion Pump

- An **infusion pump** is a medical device used to deliver fluids, medications, or nutrients to patients in a controlled and accurate manner. Here are the key points to understand:

- **Key Features:**

- **Accurate Delivery:** Infusion pumps can deliver precise amounts of fluids or medications, ensuring the correct dosage is administered.

- **Small Volume Delivery:** They can deliver small volumes of medication, starting as low as **0.1 mL per hour**.

Types of Pumps:

- **Large Volume Pumps:** Typically used to administer nutrients or larger volumes of fluids (e.g., IV fluids).

- **Small Volume Pumps:** Designed for administering medications in smaller quantities (e.g., insulin, nitroglycerin).

Subcutaneous Injection: How to Administer

- **Wash and dry your hands**.
- **Reassure the patient** and explain what you are going to do.
- **Uncover the injection area** (arm, forearm, thigh, or abdomen).
- **Disinfect the skin** with antiseptic.
- **Pinch the skin**, lifting a fold of it.
- **Insert the needle** at a **20 to 30**-degree angle into the base of the skin fold.

- **Release the skin**.
- **Aspirate** briefly (pull back on the syringe); if blood appears, stop, replace the needle, and start again.
- **Inject slowly** over **0.5-2** minutes using a small needle.
- **Withdraw the needle** quickly.
- **Press cotton wool** on the site and fix with tape.
- **Check the patient's reaction** and reassure them if needed.
- **Dispose of waste properly** and wash your hands.

Intramuscular Injection: How to Administer

- **Wash your hands**.
- **Reassure the patient** and explain the procedure.
- **Uncover the injection site** (upper gluteus, side of thigh, or deltoid muscle).
- **Disinfect the skin**.
- Ask the patient to **relax** **the muscle**.
- **Insert the needle** quickly at a **90-degree** angle (ensure correct depth).

- **Aspirate** briefly; if blood appears, replace the needle and start again.
- **Inject slowly** to reduce pain.
- **Withdraw the needle** quickly.
- **Press cotton wool** on the site and fix with tape.
- **Check the patient's reaction** and reassure them.
- **Dispose of waste properly** and wash your hands.

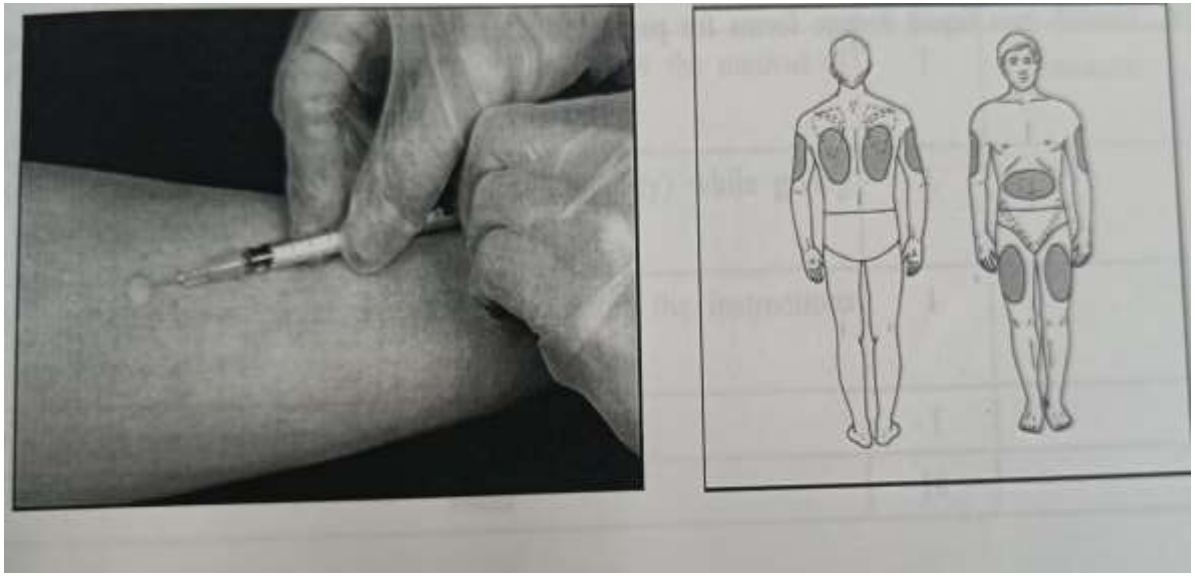
Intradermal Injection: How to Administer

- **Wash and dry your hands**.
- **Reassure the patient** and explain the process.
- **Uncover the injection site** (forearm, deltoid, or below the scapula).
- **Disinfect the skin**.
- **Insert the needle** at a **10-15** degree angle, just under the skin, with the bevel facing up.

- **Push the needle** in slightly past the bevel, inject the medication slowly, and remove the needle at the same angle.

- **Do not press or massage** the injection site and avoid using a bandage.

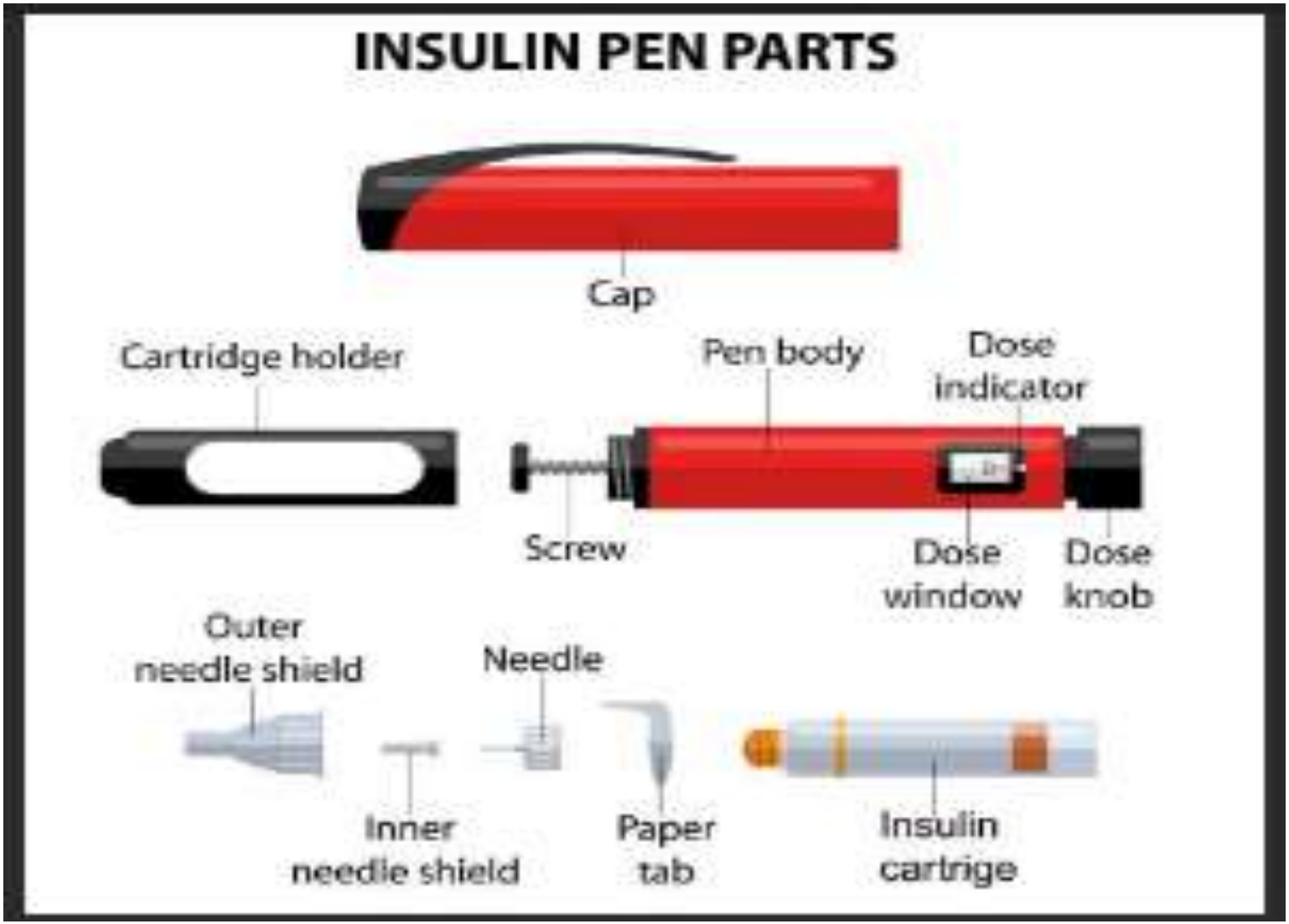
- **Dispose of the needle and syringe** properly.



NEWER DEVICES FOR SELF-ADMINISTRATION

1. Pen Device

- **Components:** Pen-shaped container, cartridge, and dial for adjusting dose.
- **Uses:** Insulin, parathyroid hormone, etc.
- **Types:**
  - **Durable:** Replaceable cartridge.
  - **Pre-filled:** Disposable after use.
- **Injection sites:** Abdomen, buttocks, upper arms, and thighs.


INSULIN PEN PARTS
Cap
Cartridge holder
Pen body
Dose indicator
Screw
Dose window
Dose knob
Outer needle shield
Needle
Inner needle shield
Paper tab
Insulin cartrige

Insulin Pen Injection Technique:

- **Wash hands:** Proper hygiene is crucial to prevent infection at the injection site.
- **Check the expiry date:** Ensures the insulin is still safe and effective to use.
- **Bring insulin to room temperature:** Cold insulin may cause discomfort during injection. Allowing it to warm to room temperature can make the injection more comfortable.
- **Ensure enough insulin for the dose:** Confirm there's sufficient insulin in the pen for the required dose.

- **Re-suspend insulin if required (roll gently 20 times):** If using a suspension insulin (like NPH), gently roll the pen to evenly mix the insulin without creating air bubbles.

- **Attach a new needle:** Always use a new, sterile needle to avoid contamination and ensure proper injection.

- **Prime the pen (ensure a drop of insulin at the needle tip):** Priming removes air bubbles and ensures that the pen is working properly before administering the dose.

- **Dial the correct dose:** Adjust the pen to the prescribed insulin dose using the dial on the device.

- **Choose an injection site:** Common sites include the abdomen, thighs, or upper arms, where subcutaneous tissue is easily accessible

- **Inject at a 90-degree angle:** Proper technique ensures the insulin is delivered to the subcutaneous tissue for optimal absorption.

- **Press the dose button and count to 10:** Holding the needle in the skin for 10 seconds ensures that the full dose is administered before removing the needle.

- **Remove the needle from the skin:** After injection, withdraw the needle carefully to avoid any discomfort.

2. Auto-Injector

- **Purpose:** Delivers a single, accurate dose of emergency drugs (e.g., epinephrine for allergies, atropine for nerve agent exposure).

- **Mechanism:** Spring-loaded needle delivers the drug intramuscularly, usually in the thighs or buttocks.

- **Built-in safety mechanisms** prevent accidental injections, ensuring the needle remains covered until the device is properly activated. This protects the user from unintentional needle sticks.

Steps for Use:

- **Break the safety seal**: Remove the safety cap or seal that protects the needle and prevents accidental activation.
- **Place the injector on the injection site**: Common sites are the thighs or buttocks, depending on the emergency drug.
- **Press firmly to inject**: Push the device into the skin firmly. The spring mechanism will automatically insert the needle and deliver the medication into the muscle.
- **Dispose of the auto-injector safely**: After use, the injector should be disposed of in a proper sharps container to prevent injury or contamination.

3. Jet Injectors

- **Function:**
- Jet injectors deliver **medication through the skin** using a high-pressure stream of liquid. Unlike traditional injections, they don’t use needles, which can make them less intimidating for patients who have needle anxiety.

- **Power Source:**
- The jet of medication is created by **compressed air**, a **gas cartridge**, or a **spring**. These mechanisms generate enough pressure to push the medication through the skin and into the body.

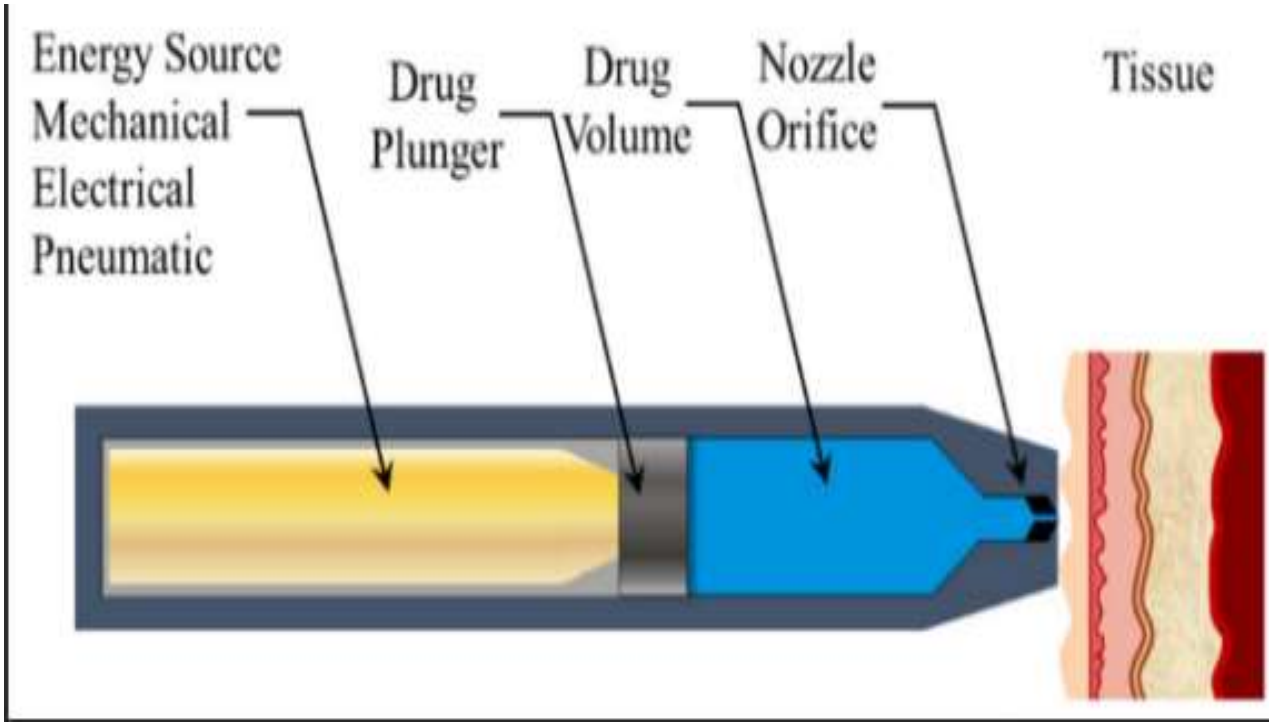
- **Uses:**
- Jet injectors are used for delivering **insulin** to diabetic patients. The absence of needles can make insulin administration easier and more comfortable for some people.

- **Drawbacks:**

- **Costly:** Jet injectors are generally more expensive than traditional syringes or pens.

- **Sterilization:** The device needs to be sterilized after each use to avoid infection, which adds to the cost and effort required.

- **Loading medication:** Proper loading of the medication before use can be complex and requires care to ensure the correct dosage is delivered.


Energy Source
Mechanical
Electrical
Pneumatic
Drug
Plunger
Drug
Volume
Nozzle
Orifice
Tissue