SOP on Demonstration of Subcutaneous Insulin Injection Technique

Department of Pharmacology
Faculty of Medicine
UWUSL

STANDARD OPERATING PROCEDURE (SOP)
ON DEMONSTRATION OF
SUBCUTANEOUS INSULIN INJECTION TECHNIQUE

Title
Demonstration of Subcutaneous Insulin Injection Technique for Undergraduate Pharmacology Teaching

Issued by
Department of Pharmacology
Faculty of Medicine, Uva Wellassa University

(1) Purpose
To establish a standardized, safe, and effective procedure for administering subcutaneous insulin injections, ensuring optimal glycaemic control, preventing dosing errors, minimizing injection pain, and avoiding complications such as lipodystrophy or inadvertent intramuscular (IM) delivery.

(2) Scope
This SOP applies to medical students, medical officers, nursing staff, trained healthcare personnel, and patients or caregivers involved in preparing, administering, or supervising insulin therapy.

(3) Responsibilities
(3.1) Lecturer (Academic Staff)
1. Provide theoretical knowledge on insulin types, formulations, pharmacokinetic profiles, and storage requirements.
2. Demonstrate correct injection techniques utilizing syringes, vials, and insulin pens.
3. Supervise and guide students, healthcare professionals, and patients during clinical training.
4. Audit injection practices, review site rotation schemes, and inspect injection areas for complications.

(3.2) Healthcare Professionals / Students
1. Assess patient history, including medication regimens, physical dexterity, cognitive status, and visual or hearing impairments.
2. Inspect and palpate selection sites to identify contraindications like lipohypertrophy, infection, or scarring.
3. Verify syringe-vial or pen-cartridge compatibility before preparing a dose.
4. Perform and teach the correct injection technique (including lifting a skin fold and rotating sites)
5. Monitor, record, and manage adverse clinical outcomes such as hypoglycaemia.

(4) Ethical and Academic Considerations

1. Request informed patient consent before demonstrating or performing the technique.
2. Maintain patient privacy and dignity during site selection and physical inspection.
3. Counsel patients regarding myths, anxieties, or needle phobias to safely empower self-management.
4. Train individuals in the immediate identification and emergency nutritional management of hypoglycaemic episodes.

(5) Prerequisites

1. Verification of the exact insulin type, dose, and mealtime schedule.
2. Pre-injection clinical assessment of the patient's injection sites, visual capacity, and cognitive skills.
3. Clean environment and availability of standard disposal equipment.
4. Availability of an immediate fast-acting glucose source to manage potential acute hypoglycaemia.

(6) Materials Required

1. Insulin Formulations: Soluble (clear), Isophane/NPH (cloudy), or pre-mixed biphasic vials/cartridges.


℞ ISOPHANE INSULIN INJECTION I.P.
Huminsulin®
ह्युमिन्सुलिन
N
(NPH)
Monocomponent Human Insulin
(recombinant DNA origin)
Lilly
℞ ISOPHANE INSULIN INJECTION I.P.
Huminsulin® N
(NPH)
ह्युमिन्सुलिन
5 908000 151291


10 mL Vial
℞
100 IU/mL
Biphasic Isophane
Insulin Injection BP
30/70 (r-DNA Origin)
Mixsulin® 30/70
Suspension for Injection
for subcutaneous use
DOSSMEGT
℞ 100 IU/mL
Biphasic Isophane
Insulin Injection
IP / BP / Ph EUR
30/70 (r-DNA Origin)
Mixsulin® 30/70
10 mL Vial

2. U-100 insulin syringes (1 mL or 0.5 mL)
   - Strength 100 IU/mL insulin must always be used with a U-100 syringe.
   - Not all 1 mL syringes are insulin syringes—ensure it is clearly marked as a U-100 syringe with the correct needle gauge and length.

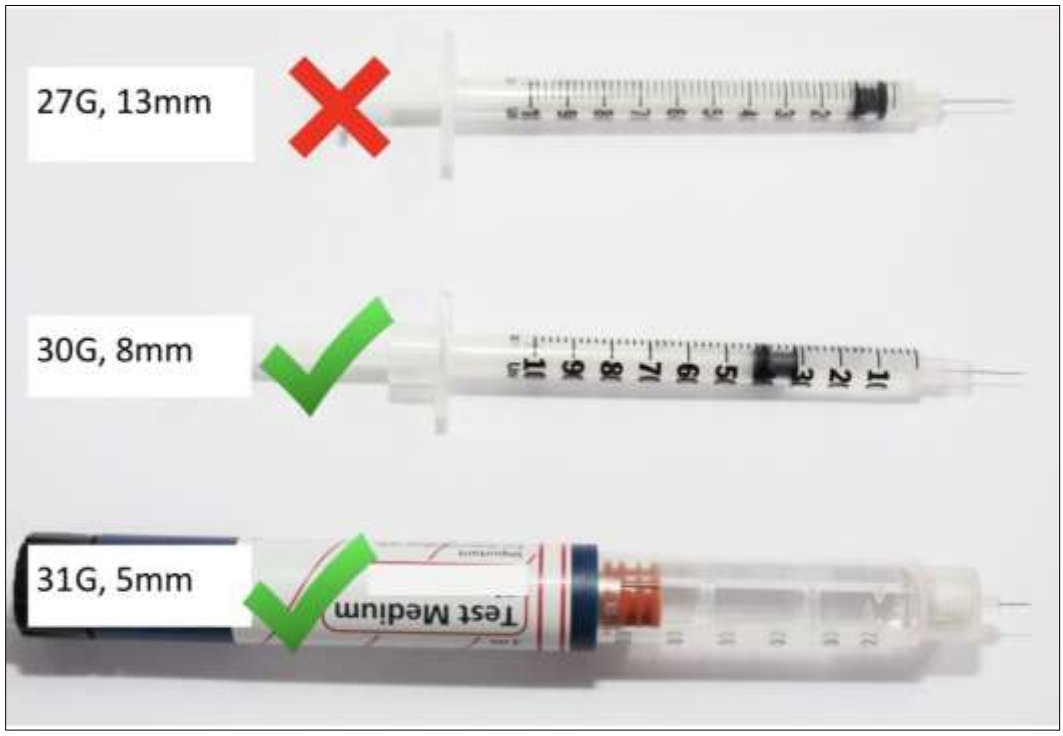
   - U-100 syringes usually have:
     - Orange needle cover
     - Black calibrations up to 100 units

3. Short, fine-gauge needles (29G–31G; 6–8mm for adults, 4–6mm for children).
   - Recommended gauge: 29G–31G for subcutaneous insulin injections.
     - Avoid <29G needles as they are thicker and more painful.
     - Higher gauge = thinner needle = less pain.

- Recommended length: 4–6 mm for children, adolescents, and adults (including obese patients).
  - Safe and effective as they avoid intramuscular injection and reduce pain/leakage.

- Needles >6 mm (e.g., 8 mm and above):
  - Risk of intramuscular injection → hypoglycaemia
  - Must be used with a skin fold or at 45° angle
  - Generally, not recommended routinely
  - IM insulin only for hyperglycaemic emergencies

- Examples:
  - 31G, 5–6 mm → preferred (especially pen devices)
  - 30G, 8 mm → use only if shorter needles are not available, with skin fold
  - 27G, 13 mm → not recommended



4. Insulin Pen devices with recommended pen needles (30G–32G; 4–6mm length).
   - An insulin pen uses only one type of insulin cartridge at a time (e.g., soluble, isophane, pre-mixed insulin, or insulin analogues).
   - Two types of insulin pens:
     - Reloadable pens (replaceable cartridges)
     - Disposable pens (pre-filled cartridges)
   - Insulin pens provide convenient and accurate insulin delivery, especially useful for children, busy individuals, and during travel.
   - Pen needle specifications:

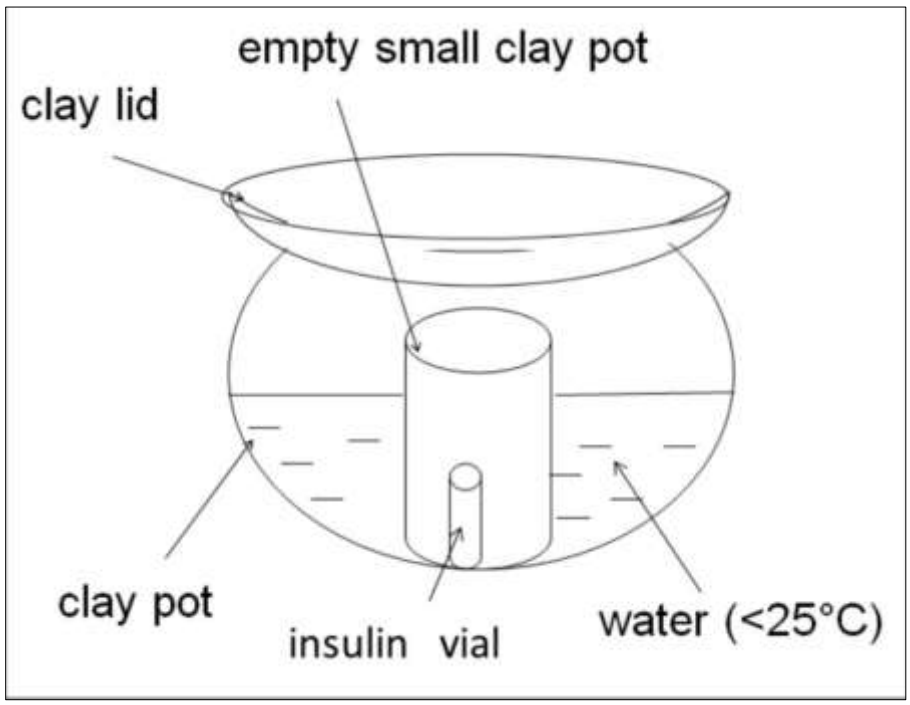
- Recommended gauge: 30G–32G
- Recommended length: 4–6 mm

5. Cleansing Agents: Alcohol swabs, surgical spirit swabs, or cotton balls dipped in water.
6. Disposal Equipment: Sharp collectors, "safe clips", or labeled puncture-proof hazard boxes.

(7) Storage and stability

- Refrigerator storage: Store insulin vials ideally at 2–8°C, preferably in the middle compartment of the refrigerator. Do not store them in the refrigerator door.

- If a refrigerator is unavailable: Store the in-use vial in a cool place (<25°C), wrapped in a plastic bag, or kept in a clay pot or insulated flask.



- Room temperature use: If stored above 25°C, use only for 2–3 weeks and then discard.
- In hospital wards: In-use vials should still be kept in a refrigerator to prevent contamination and temperature fluctuations.
- Do not freeze insulin: Freezing destroys insulin, and it must be discarded if frozen.
- Avoid heat/light: Do not store near sunlight, stoves, heaters, or in cars.
- Expiry: Never use insulin beyond the expiry date.

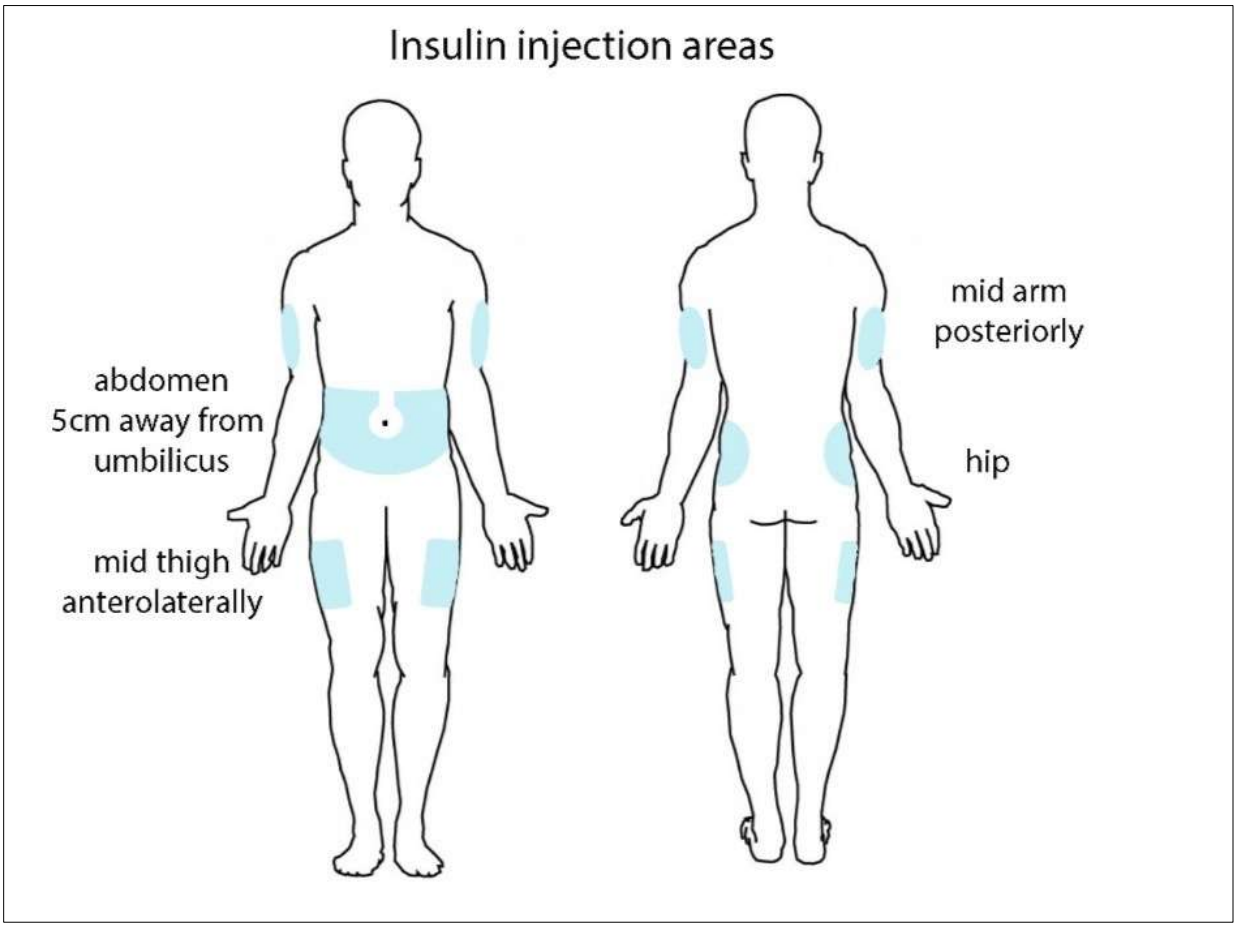
- Before use:
    - Clear insulin should be transparent and particle-free.

    - Suspension insulin should be gently rolled (not shaken) and appear uniformly milky white before injection.

(8) Areas for subcutaneous insulin injection

Insulin is injected into the fat tissue layer under the skin (subcutaneously) and should not be given into the muscle (intramuscularly)

1. Anterior abdomen: 5cm away from the umbilicus laterally, and 2.5cm above and below the umbilicus.
2. Arm: posterior middle third of the arm, between the shoulder and elbow joints.
3. Thigh: anterior and outer aspect of the middle third of the thigh, between the anterior superior iliac spine and the knee joint.
4. Buttocks: upper outer quadrant, more suitable for children. (Buttocks are usually avoided for insulin injection in older children and adults).



(9) Procedure

(9.1) Exclusion Criteria (to be determined by Lecturer/Academic staff before testing)

- Avoid injecting into areas with active infection, acute inflammation, ulcers, keloids, or major surgical scars.
- Strict Contraindication: Do not inject into localized areas of lipohypertrophy until the tissue returns to normal.
- In pregnant patients (3rd trimester), avoid the central umbilical area and any abdominal area overlying the fetus.

(9.2) Rotation of injection sites

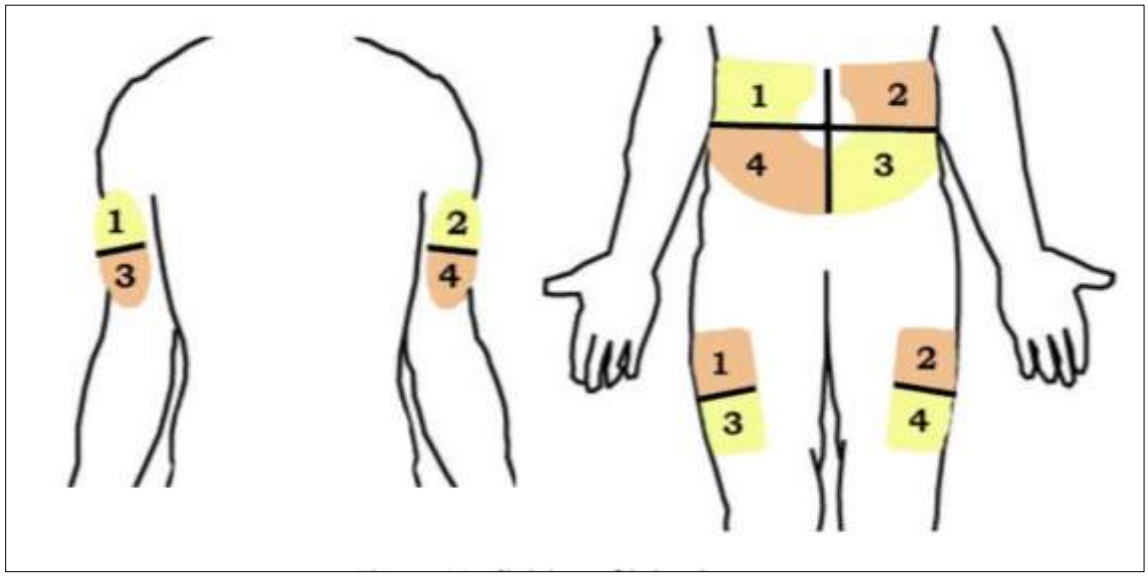
- The point or site of insulin injection should be changed daily, within the same area.
- If insulin is injected into the same site (point on the surface of the skin) in a particular area, it leads to lipodystrophy (lipohypertrophy with human insulin and lipoatrophy with animal insulin).
- Insulin injected into areas of lipodystrophy is absorbed irregularly. Repeated injection into the same site can also cause skin damage, bleeding, etc.

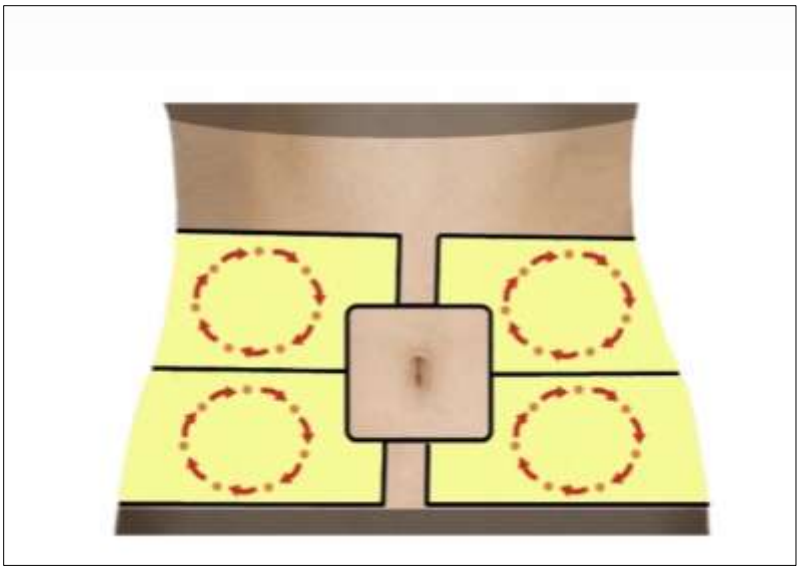
(9.3) Site Rotation Scheme

Option 1

The selected area for injection should be divided into halves or quadrants, depending on the size of the area

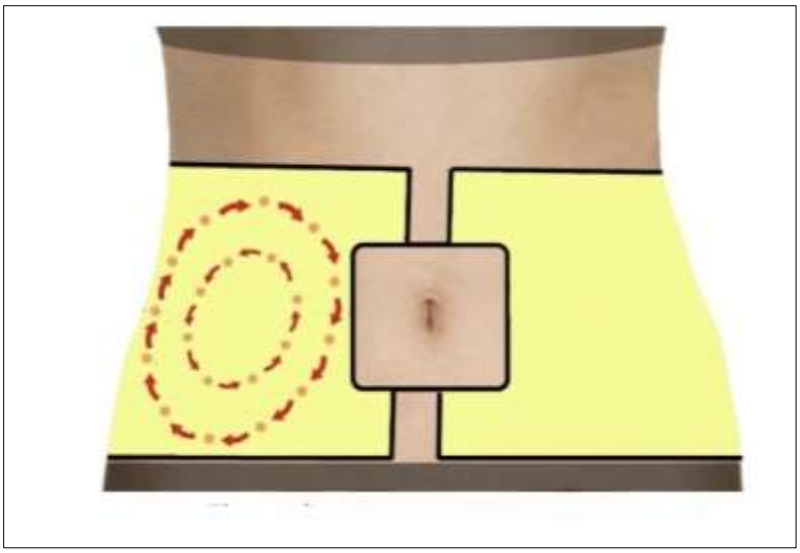
- Within each division, the injection site should be rotated.
- This should be in the same direction, either clockwise or anti-clockwise.
- Each site (point of injection) should be spaced a minimum of 1cm from the others to avoid repeated tissue trauma.
- The point of injection should be rotated in each division over several days. Then move on to the next division.





Option 2

- The area may be divided into outer and inner circles. Site rotation can be done either clockwise OR anti-clockwise consistently.
- Allow the patient or caregiver to select the most convenient method of site rotation from the options above.
- Site rotation should be audited at review and recorded.



(9.4) Pre-Procedure Preparation

1. Remove insulin from the refrigerator 15–30 minutes prior to injection to allow it to reach room temperature.
2. Verify the drug name, formulation, concentration (e.g., U-100), and expiry date.
3. Perform hand hygiene and dry hands thoroughly.
4. Ensure the selected site is "socially clean." If cleaning is required, apply an alcohol swab or water in an outward circular motion and allow the skin to dry completely.
5. For Insulin Suspensions (Cloudy/Biphasic): Gently roll the vial/pen between palms or tilt 20 times to achieve a uniform milky white appearance. Do not shake.

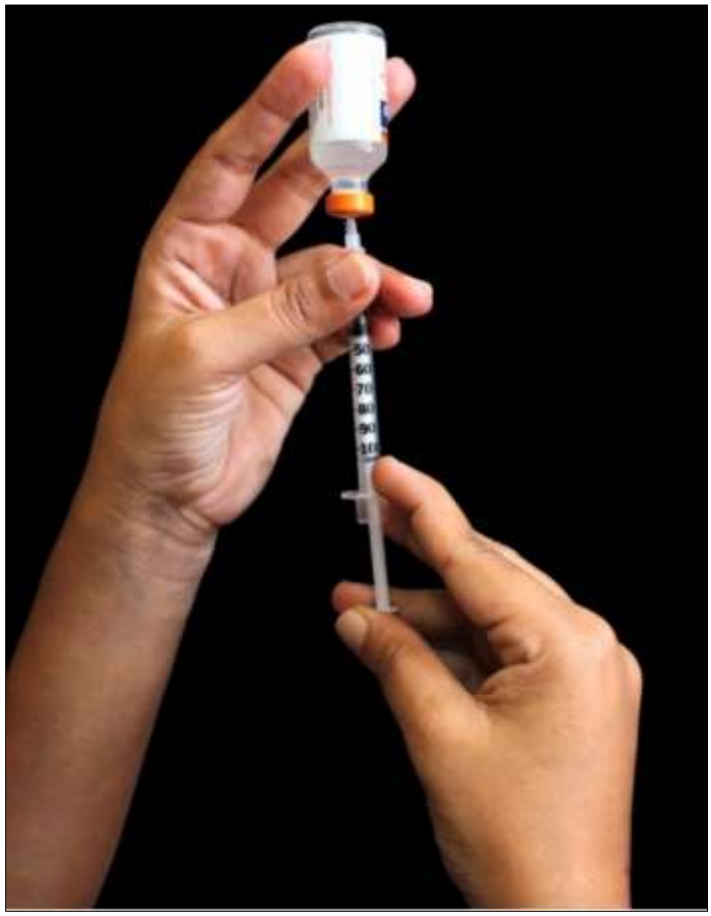
(9.5) Single Insulin Preparation & Injection Technique (Syringe and Vial)

1. Wipe the top rubber stopper of the vial with a spirit swab. allowed to dry completely.

2. Draw air into the syringe equivalent to the prescribed insulin dose.

3. Pierce the center of the stopper at a 90° angle and inject the air.

4. Invert the vial and smoothly draw slightly more than the needed dose. Tap to clear air bubbles, push the excess back, and establish the exact dose mark.

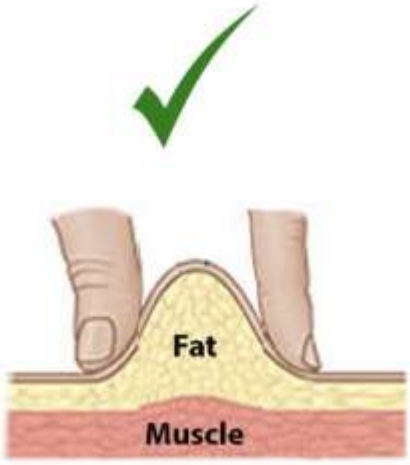


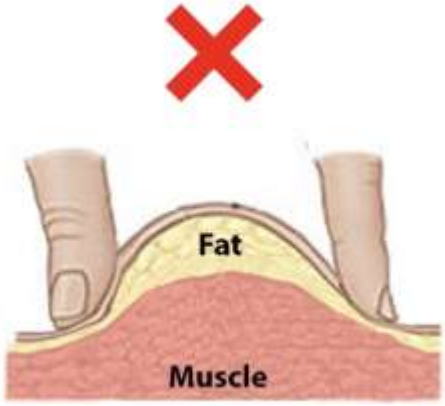
5. Remove the needle from the vial carefully by the barrel.
6. Gently lift a subcutaneous skin fold using only the thumb and index/middle fingers (avoiding muscle capture).

TAKING A SKIN FOLD

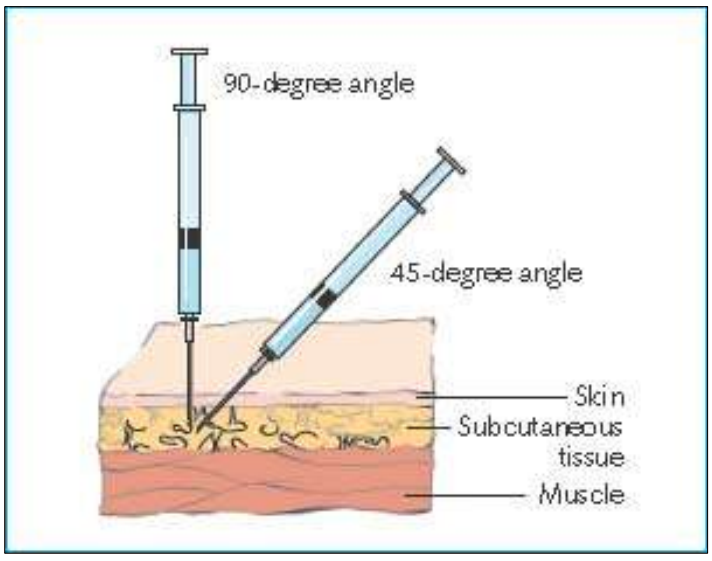
Correct method

Wrong Method





7. Insert the needle smoothly at a 90° angle (or 45° if clinically indicated for specific populations/8mm needles) and inject the dose steadily.



8. Hold and count slowly for 10 seconds before withdrawing the needle to prevent tracking/leakage.
9. Release the skin fold, press firmly with dry cotton wool (do not massage), and safely discard the syringe.

(9.6) Mixing Two Types of Insulin in a Single Syringe

1. Inject air equal to the cloudy (intermediate/NPH) dose into the cloudy vial without letting the needle touch the liquid. Withdraw the empty syringe.
2. Inject air equal to the clear (short/rapid-acting) dose into the clear vial.
3. Invert the clear vial, remove bubbles, and draw up the precise clear insulin dose first.
4. Insert that clear insulin-filled syringe into the cloudy vial, invert it carefully, and draw the cloudy insulin up to the total combined dose. Do not overdraw, as it cannot be pushed back. Inject immediately.

(9.7) Insulin Pen Technique

1. Attach a new sterile pen needle and prime it by selecting 1–2 units, pointing it upward, and pressing the button until insulin drops appear.

2. Dial the prescribed dose using the clockwise click-selector.

3. Insert the needle straight at a 90° angle into the clean site (using a skin fold where recommended).

4. Fully depress the push button until the display returns to zero, and wait 10 seconds before withdrawing the device.

5. Detach and safely dispose of the pen needle immediately after to prevent air entry or solution leaking.

(10) Interpretation of Results

- Unlike diagnostic skin prick testing, "interpretation" centers on safe pharmacokinetic intervals and clinical observation:
- Onset of Action Compliance: Ensure the injection-to-mealtime gap matches the specific insulin variant:
- Human Soluble / Biphasic: 20–30 minutes before a meal.
- Rapid-Acting Analogues: Up to 15 minutes before or 20 minutes after starting a meal.
- Long-Acting Analogues: Same time daily, independent of meal timing.
- Local Inspection Metrics: Monitoring the skin for absence of bruising, bleeding, or underlying rubbery tissue masses (lipohypertrophy).

(11) Precautions

1. Always Ensure Syringe-Vial Compatibility: Match U-100 insulin exclusively with U-100 syringes to avoid catastrophic dosing errors.
2. Never Mix Glargine: Do not mix long-acting insulin glargine with any other formulations.
3. Enforce Daily Site Rotation: Systematically rotate the precise injection point 1 cm apart within the chosen zone using a clear grid or quadrant method.
4. Avoid Recapping: Do not recap needles manually; use safe clips or sharps buckets to eliminate needlestick injuries.

(12) Limitations

1. Needle reuse (common in low-resource settings) blunts the tips, strips the lubricating silicone coating, increases infection risks, causes unpredictable tissue trauma, and results in dose inaccuracies.
2. Individual variations in subcutaneous fat depth across varying demographic populations can shift the risk profile for unintended, painful intramuscular entry.

(13) Records and Documentation

Document the following information using the tracking tools provided in the Insulin Injection Initiation Card:

1. Date, time, and precise anatomical zone used.
2. Device used, needle length, and gauge specifications.
3. Exact unit dosage and chemical formulation types.
4. Localized dermatological presentation (e.g., presence or absence of lipodystrophy).
5. Checklist tracking skills transfer (vial selection, dose selection, technique, storage mastery).

(14) References

1.Katzung BG. Basic & Clinical Pharmacology. 16th Edition. Chapter 41: Pancreatic Hormones and Glucose-Lowering Drugs.
2.World Health Organization (WHO). Guidelines on Diabetes Management. (2018)
3.Best practice in insulin injection technique: A simplified guideline. Ministry of Health, Nutrition and Indigenous Medicine, Sri Lanka, in collaboration with the NIROGI Lanka Project, Sri Lanka Medical Association (2017).

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