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Principles and Routes of Medication Administration

DND Primary Care Paramedicine

Module: 02

Section: 08

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Lecture Outline

- Introduction
- Aseptic technique
- Legalities and policies
- Adverse drug events
- Special considerations
- Medication administration routes
- Medication packaging
- Drawing up medications

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Body Substance Isolation Equipment

Body Substance Isolation Equipment

- Always take appropriate body substance isolation measures to reduce your risk of exposure during medication administration.

Medical Asepsis

- Asepsis
  - Condition free of pathogens
- Sterile
  - Free of all forms of life
- Medically clean
  - Involves careful handling to prevent contamination

Body Substance Isolation Equipment

- Treat all blood and body fluids as potentially infectious.

Needle Handling Precautions

- Minimize the tasks performed in a moving ambulance.
- Immediately dispose of used sharps in a sharps container.
- Recap needles only as a last resort.

Seven Rights of Drug Administration

- Right person
- Right drug
- Right dose
- Right time
- Right route
- Right documentation
- Right to refuse at any time

Drug Administration

- Knowing all drug administration protocols is essential.

Medical Direction

- Paramedics do not practice autonomously
- Medical director will determine which medications you will use and by what routes

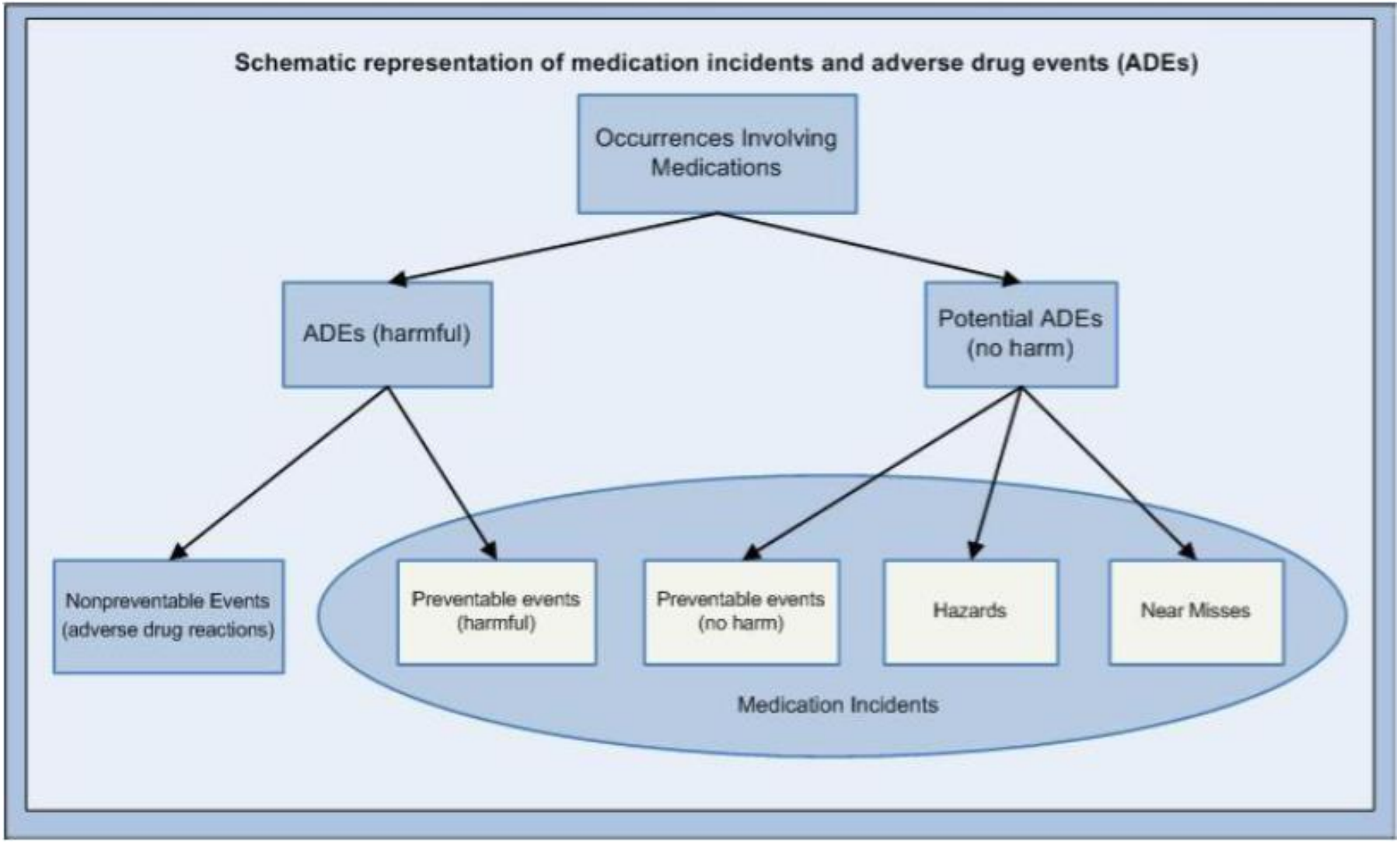
Standing Orders

- Standing orders authorize you to perform certain procedures without contacting a physician
  - Most often encountered in settings where patient needs have been defined that can be met competently by a health care provider
  - Example: registered nurses in the PACU at NHI can admin 0.5mg atropine IV for patients with HR <40
- Not often encountered in the prehospital setting where paramedics work under protocols and guidelines

Medication Errors

- Canadian Adverse event study
  - 7.5 adverse events per 100 admitted hospital patients
  - 37% preventable
  - 9,250 – 23,750 preventable deaths
  - Drugs were the second most common cause of adverse events behind surgery
- Need to move away from a culture and blame and shame to a culture of reporting and learning from our mistakes
- High alert medications have an increased risk of harm when they are used in error
  - Pre-hospital examples of high alert medications
    - Dextrose higher than 20%, amiodarone, epinephrine, neuromuscular blockers
  - In hospital policies often include double checks

Adverse Drug Events



Reporting

- Med errors and near misses
  - Institute for safe medication practices (ISMP) Canada (www.ismp-canada.org)
    - Independent, non-for-profit organization committed to advancement of medication safety in all healthcare settings
    - Anonymous reporting tool
    - ISMP reviews and analyzes medication incident and near-miss reports according to a hazard ID tool. They then can use that information to identify contributing factors, causes, and make recommendations to prevent harmful medication incidents
- Medication adverse drug reactions
  - Canada Vigilance collects post-market information through surveillance from reports of suspected adverse reactions to health products marketed in Canada

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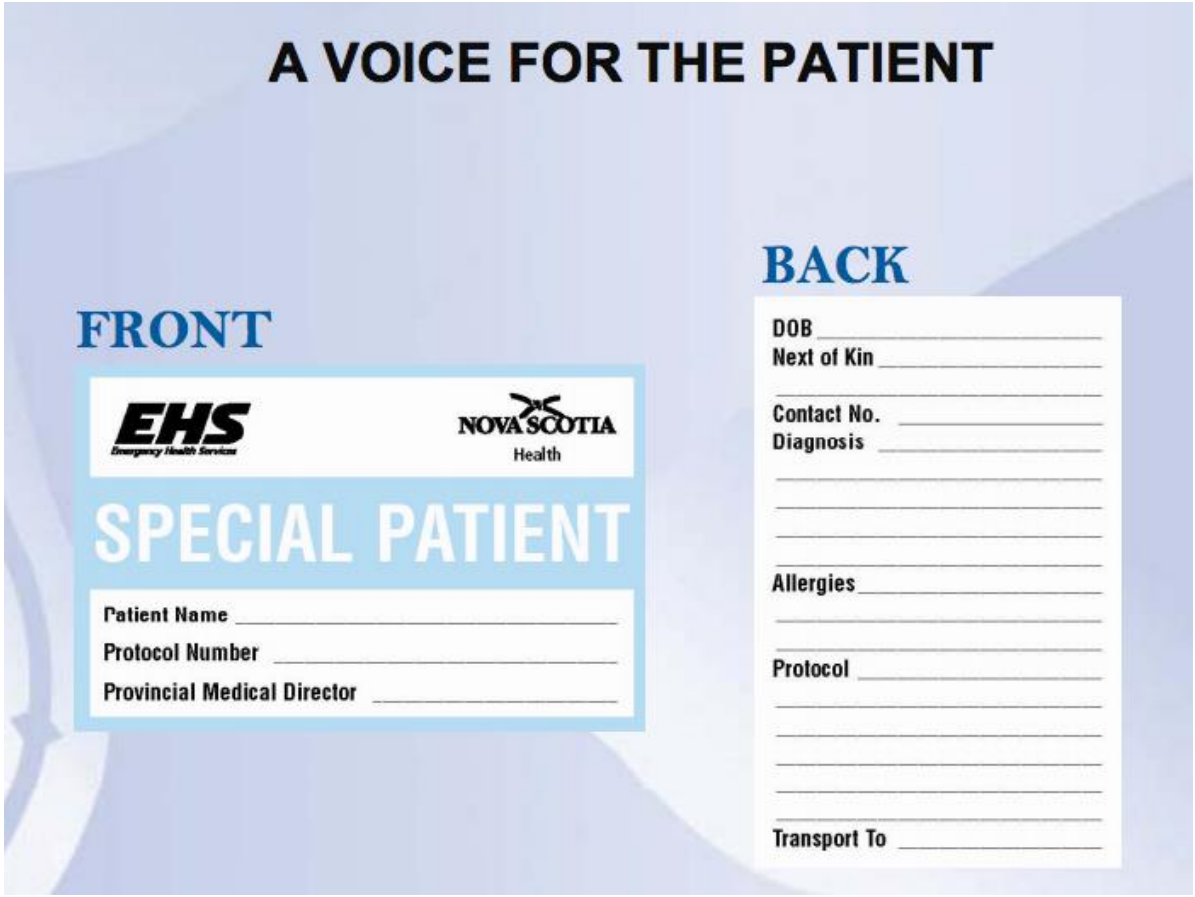
Special considerations

- Special patients



Special Considerations

- Drugs that have dosage adjustment requirements for renal or hepatic impairment
  - Most often seen with patients who have altered creatinine clearance
    - Lower creatinine clearance is a sign of decreased function
- Medications that are dosed by weight
  - Some are dose by absolute body weight and some by ideal body weight
  - Often the case with pediatric patients
    - Refer to Broselow Tape

For All Medication Administration

- Apply the following to all routes:
  - Appropriate BSI
  - Confirm indication, medication, dose, route and expiration
  - Review 7 rights of medication administration
    - Consider informed consent
      - Did you give the patient all the information on the efficacy and safety prior to administering this medication to make an appropriate decision, being mindful of what is most important to convey in emergency situations
  - Confirm medication indications and patient allergies
  - Assemble and prepare needed equipment
  - Draw up medication as appropriate

Medication Administration & Documentation

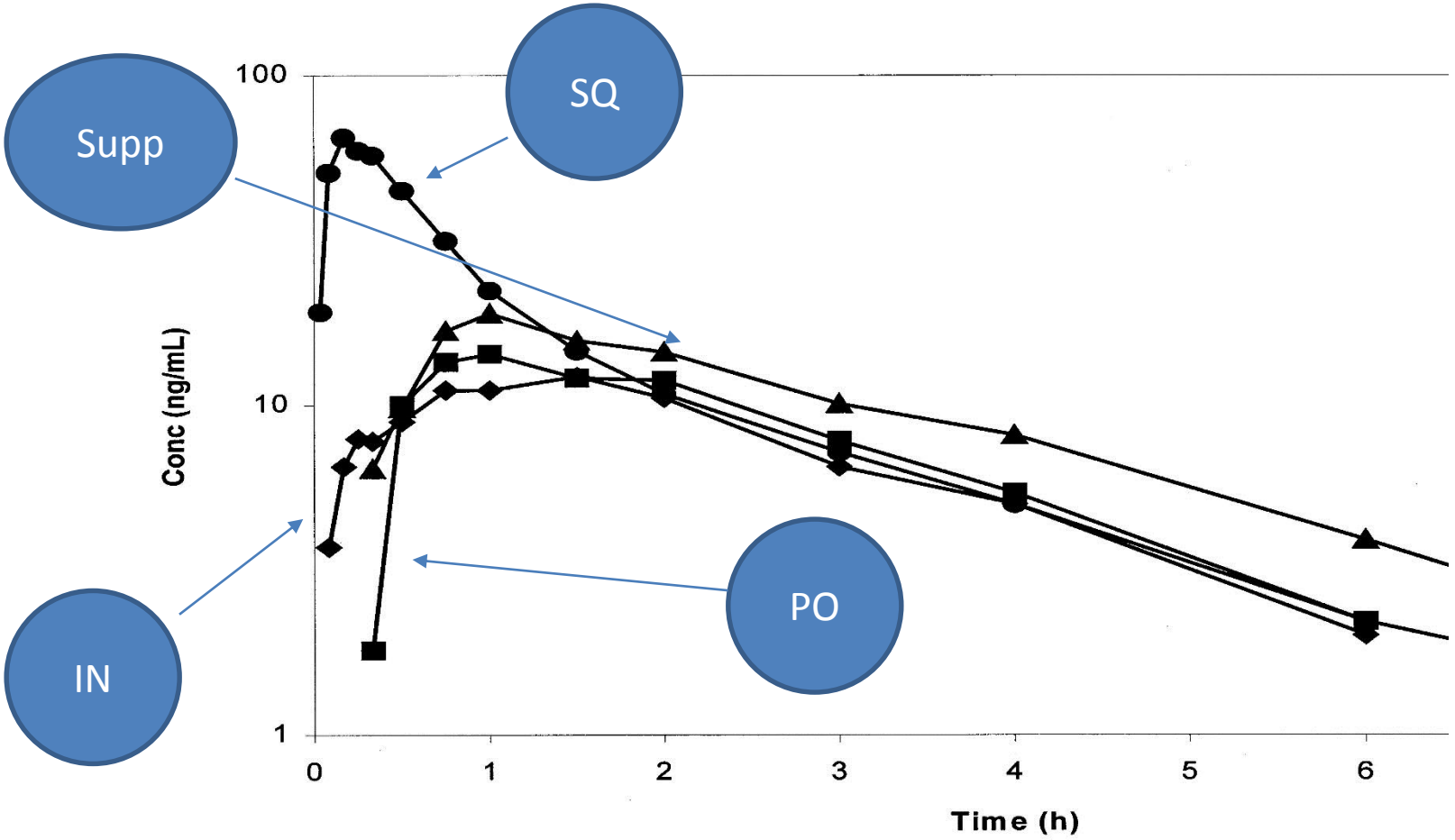
- Record all information concerning the patient and medication including:
  - Indication for drug administration.
  - Dosage and route delivered.
  - Patient response to the medication—both positive and negative.

Enteral vs Parenteral

- Enteral are medications absorbed via the gastrointestinal tract
  - Does not mean they all go through first pass metabolism
- Parenteral are medications entering via all other routes

Enteral	• Per Os (PO) - is Latin for by mouth • Sublingual (SL) • Rectal (PR) • Orogastric (OG)/Nasogastric (NG) • Buccal
Parenteral	• Intravenous • Intramuscular • Subcutaneous • Intraosseous • Umbilical
Parenteral (topical)	• Percutaneous • Ocular • Nasal • Respiratory

Contrasting Route of Administration



Duquensnoy et al., 1998. Eur J Pharm Sci. 6:99-104

- Percutaneous drug administration are drugs applied to and absorbed through the skin or mucous membranes.

Transdermal

- Absorbed through the skin at a slow, steady rate.
- Method:
  - BSI
  - Clean administration site
  - Apply medication
  - Leave medication in place for required time
  - Monitor the patient for desirable or adverse effects

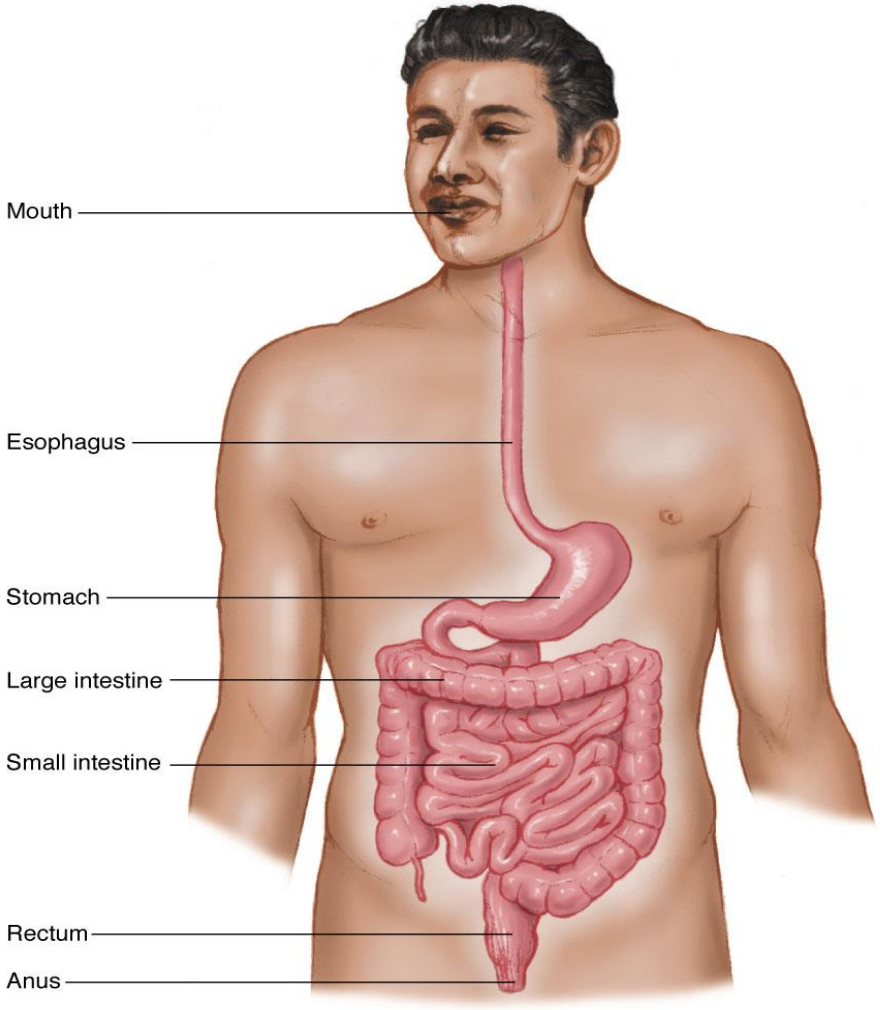
Mucous Membranes

- Absorbed through the mucous membranes at a moderate to rapid rate.
- Medication sites:
  - Tongue
  - Cheek
  - Eye
  - Nose
  - Ear

Enteral Administration

- The delivery of any medication that is absorbed through the gastrointestinal tract
- Routes:
  - Oral
  - Sublingual
  - Buccal
  - Gastric tube
  - Rectal

Gastrointestinal tract



Sublingual

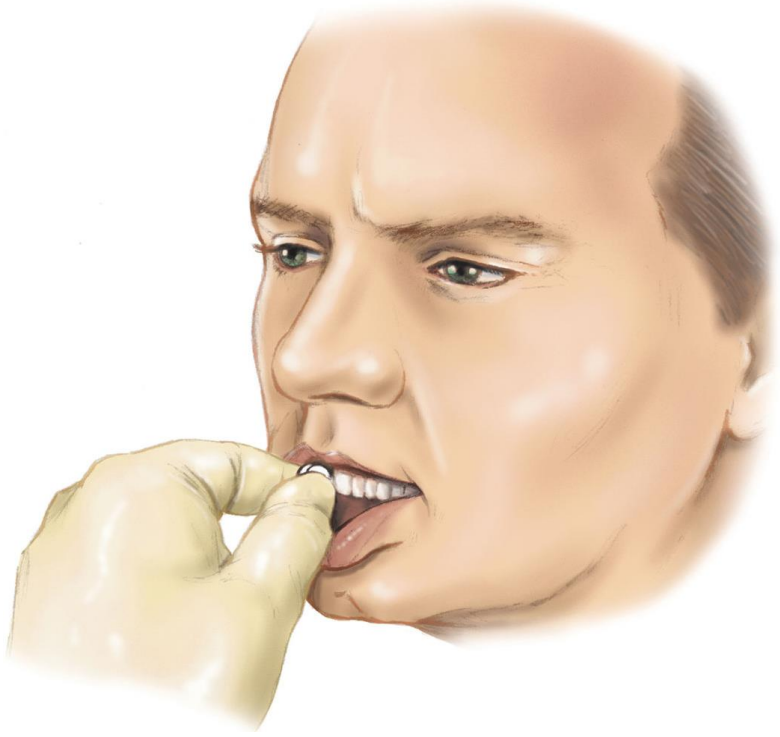
- Have your patient lift his tongue towards the top and back of his oral cavity
- Place the pill or direct spray between the underside of the tongue and floor of the oral cavity
- Monitor the patient for desirable or undesirable effects

Sublingual Medication Administration

- Place the pill or direct spray between the underside of the tongue and the floor of the oral cavity.

Buccal Medication Administration

- Place the medication between the patient's cheek and gum.



Oral Drug Administration

- Any medication taken by mouth and swallowed into the GI tract.
- Be sure the patient has an adequate level of consciousness to prevent aspiration.

Oral Drug Forms

- Capsules
- Tablets
- Pills
- Enteric coated/ time release capsules and tablets
- Elixirs
- Emulsions
- Lozenges
- Suspensions
- Syrups

Equipment for Oral Administration

- Soufflé cup
- Medicine cup
- Medicine dropper
- Teaspoon
- Oral syringe
- Nipple

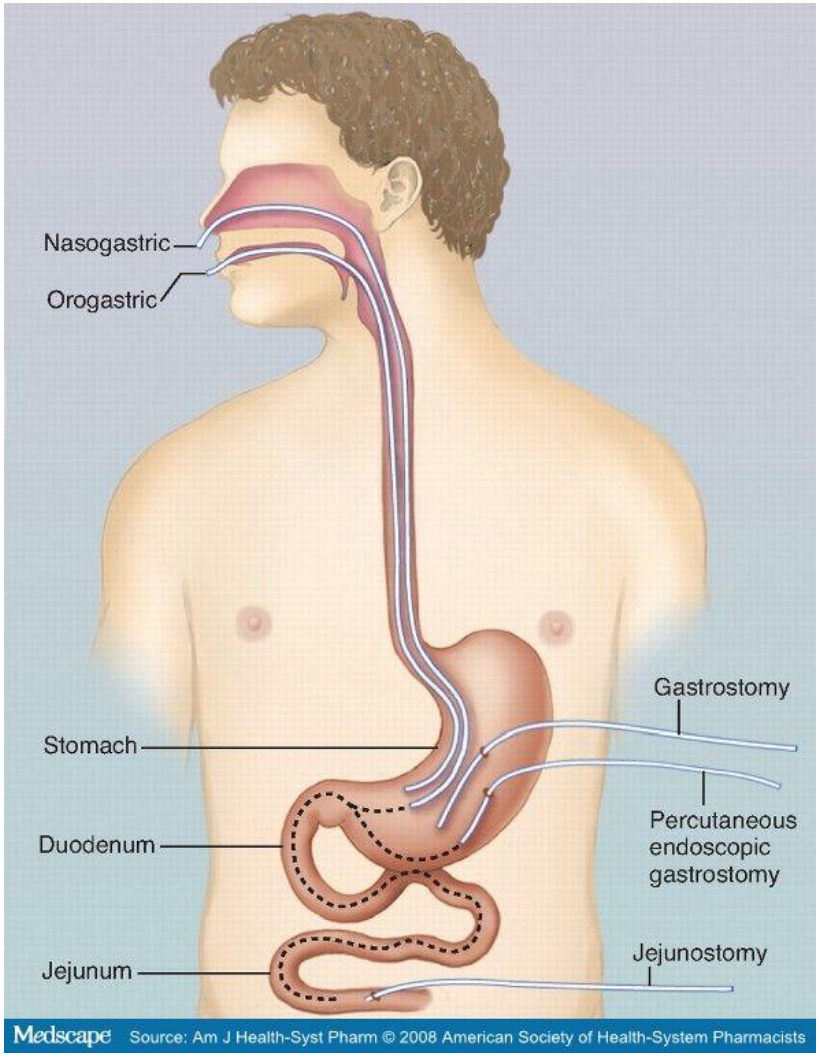
General Principles of Oral Administration

- Note whether to administer medication with food or on empty stomach.
- Gather any necessary equipment.
- Have patient sit upright when not contraindicated.
- Place the medication into your patient's mouth. Allow self administration, assist when needed.
- Follow administration with 4-8 ounces of water and ensure that patient has swallowed the medication.

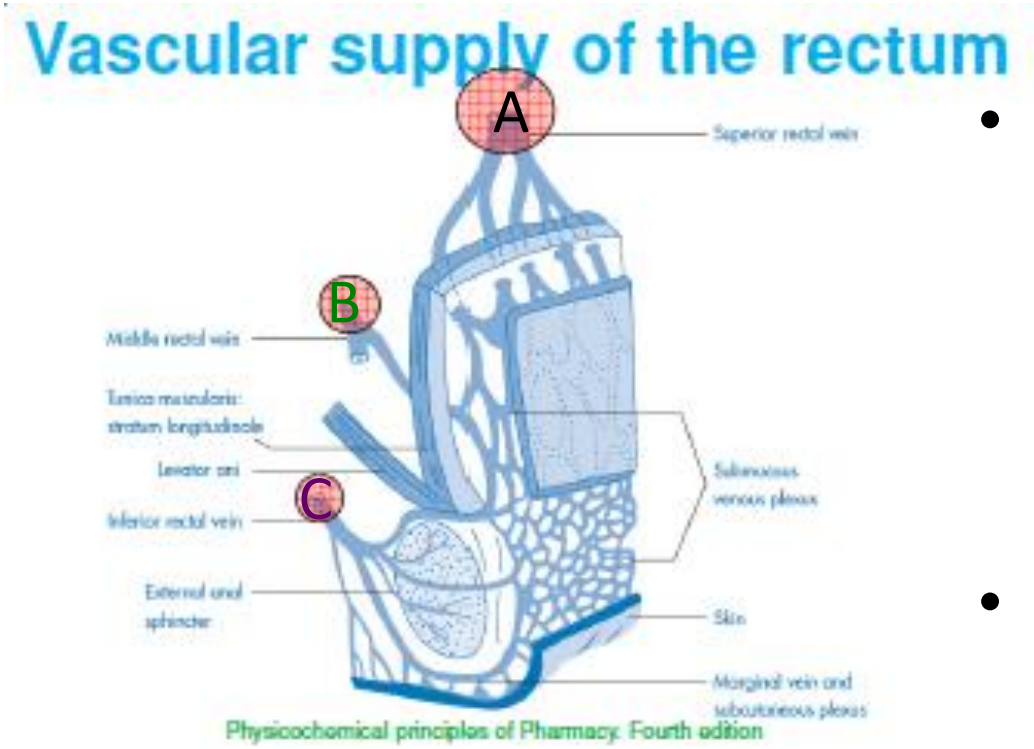
Gastric Tube Administration

- Gastric tubes provide access directly to the GI system
  - Orogastric
  - Nasogastric

Gastric Tubes



Rectal Drug Absorption



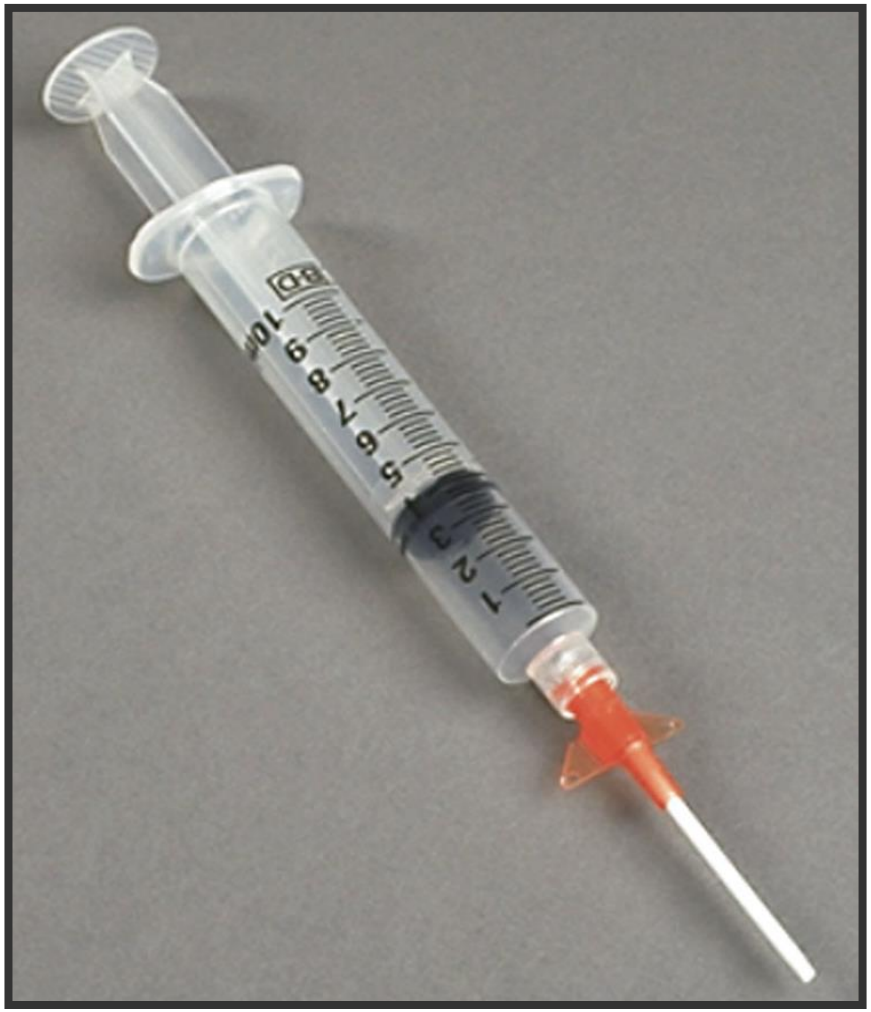
A. Superior rectal vein drains into the mesenteric vein which drains into portal vein

B. Middle rectal vein drains into vena cava

C. Inferior rectal vein drains into vena cava

- Example of the contrast between circumventing and entering portal circulation
  - Hence, rectal absorption can be erratic
- Drugs can be utilized via this route to treat local (hemorrhoids) or systemic (diazepam for seizures) conditions

Catheter placement on Needleless Syringe



Syringe Attached to Endotracheal Tube

Prepackaged Enema Container

Parenteral Administration

- Drug administration outside of the gastrointestinal tract
- Usually involves a needle

Eye Drop Administration

- Use a medication dropper to place the prescribed dosage on the conjunctival sac.

Eye Drop Administration

- Have patient tilt head back or lay down
- Avoid touching the eyelid or lashes
- Have patient look up
- Pull down on the lower eyelid to form a pouch
- Place drop into pouch
- Have the patient look down and then slowly release the lower lid
- Instruct patient to gently close eyes and try to keep them closed for at least 30 seconds, preferred up to 5 minutes
- Advisable to press down on the corner of the eye with thumb and index finger to close nasolacrimal duct
  - This promotes retention of medication and prevent swallowing of medications
- Try not to blink or rub the eye
- Note:
  - Eye drops with certain preservatives can bind to contact lenses
  - Ophthalmic suspensions should be shaken prior to instilling

Nasal Medication Administration

- Have patient blow nose
- Shake the bottle
- Have patient sit up (head not titled backwards), you or patient close on nostril
- Point bottle away from the septum, but up and back towards nasal cavity
- Have patient breathe through mouth
- Repeat to other side if needed
- Avoid blowing nose for 3-5 minutes
- Rinse tip of bottle with hot water

Pulmonary Drug Administration

- Parenteral drug administration route
- Medications are administered into the pulmonary system via inhalation or injection
- Mechanisms:
  - Small volume nebulizer
  - Pressurized metered dose
    - Spacers and holding chambers
  - Dry powder inhaler
  - Endotracheal tube

Dry Powder Inhaler

Figure 22. Currently available dry-powder aerosol formulations in the United States categorized by design features (see text description of design features)

Small Volume Nebulizer

Large Volume Nebulizer

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Metered Dose Inhaler

Metered Dose Inhaler

Figure 20. Currently available pMDI dose counters on the market

Close Mouth Technique

1. Warm the pMDI canister to hand or body temperature.
2. Remove the mouthpiece cover and shake the inhaler thoroughly.
3. Prime the pMDI into the air if it is new or has not been used for several days.
4. Sit up straight or stand up.
5. Breathe all the way out
6. Place the pMDI between their teeth; make sure that their tongue is flat under the mouthpiece and does not block the pMDI.
7. Seal their lips.
8. Actuate the pMDI as she/he begins to breathe in slowly.
9. Hold his/her breath for 10 seconds. If she/he cannot hold their breath for 10 seconds, then for as long as possible

Open Mouth Technique

- Warm the pMDI canister to hand or body temperature (if possible)
- Remove the mouthpiece cover and shake the pMDI thoroughly.
- Prime the pMDI into the air if it is new or has not been used for several days.
- Sit up straight or stand up
- Breathe all the way out.
- Place the pMDI two finger widths away from their lips.
- With mouth open and tongue flat (tip of tongue touching inside of their lower front teeth), tilt outlet of the pMDI so that it is pointed toward the upper back of the mouth.
- Actuate the pMDI as she/he begins to breathe in slowly
- Breathe slowly and deeply through the mouth and hold their breath for 10 seconds. If she/he cannot hold their breath for 10 seconds, then for as long as possible.

* If using a corticosteroid, important to rinse out mouth after use to prevent oral thrush

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Shaking and Priming

Generic Name	Brand Name	Time to Prime	No. of Sprays
Short-acting Bronchodilators			
Albuterol Sulfate HFA	ProAir HFA®	New and when not used for 2 weeks	3
	Proventil® HFA	New and when not used for 2 weeks	4
	Ventolin® HFA	New and when not used for 14 days	4

Spacer/Valve Holding Devices

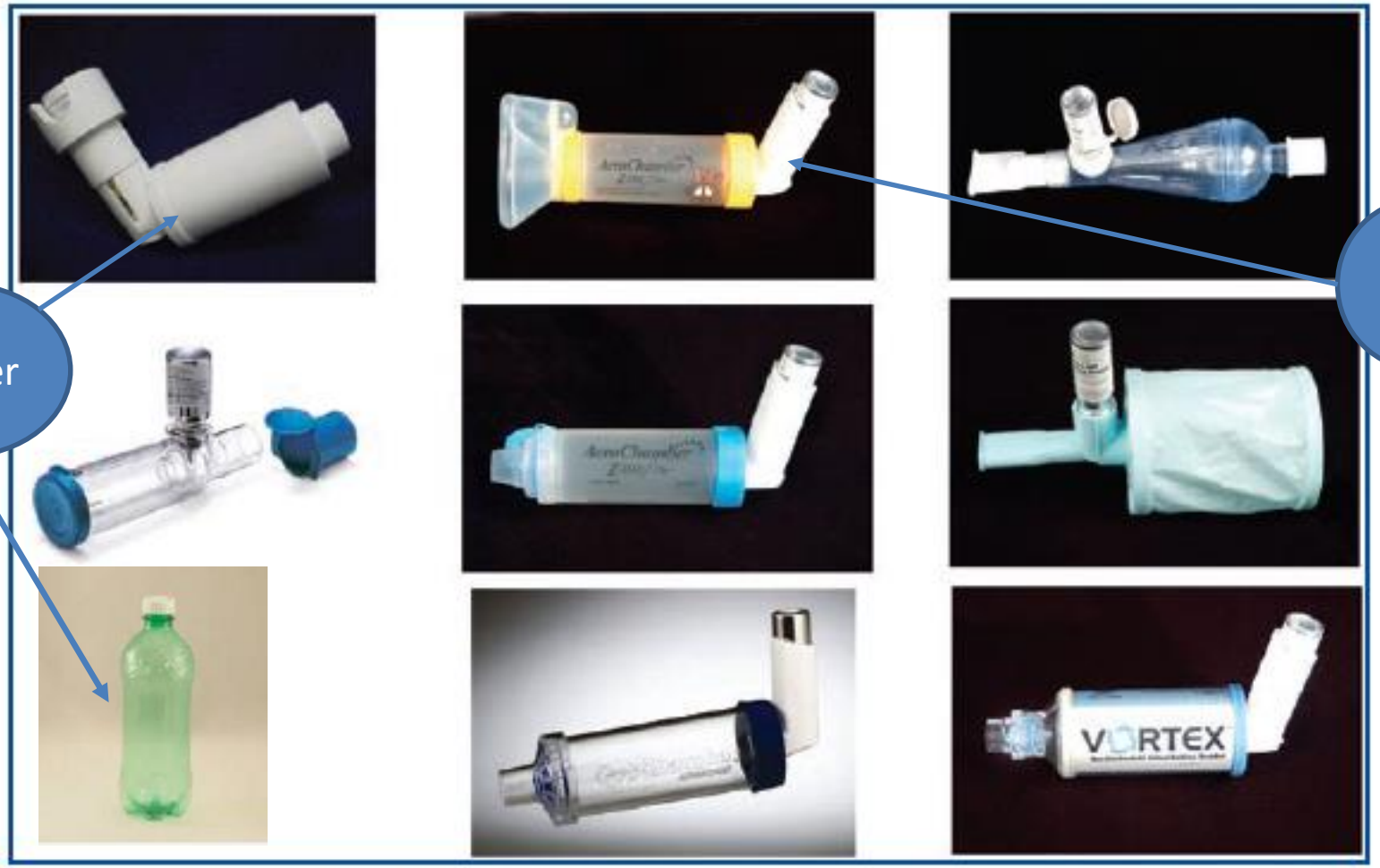

Figure 21. Examples of VHCs and spacers

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Spacer

Commercial versus home-made spacers in delivering bronchodilator therapy for acute therapy in children

Carlos E Rodriguez-Martinez[1,*], Monica Sossa[2], Juan Manuel Lozano[3]

Database Title — The Cochrane Library

Editorial Group: Cochrane Airways Group

Published Online: 23 APR 2008

Assessed as up-to-date: 17 AUG 2010

DOI: 10.1002/14651858.CD005536.pub2

Authors' conclusions

Care should be taken in the interpretation and applicability of our results because of the small number of RCTs along with few events available meeting the criteria for inclusion in the review, absence of the primary outcome of interest and other clinically important outcomes in the majority of included studies. The possible need for a face-mask in younger children using home-made spacers should also be considered in practice

"No significant differences were demonstrated between the two delivery methods in terms of the need for hospital admission"

Discussion

Advantages and disadvantages of each aerosol device

Discussion

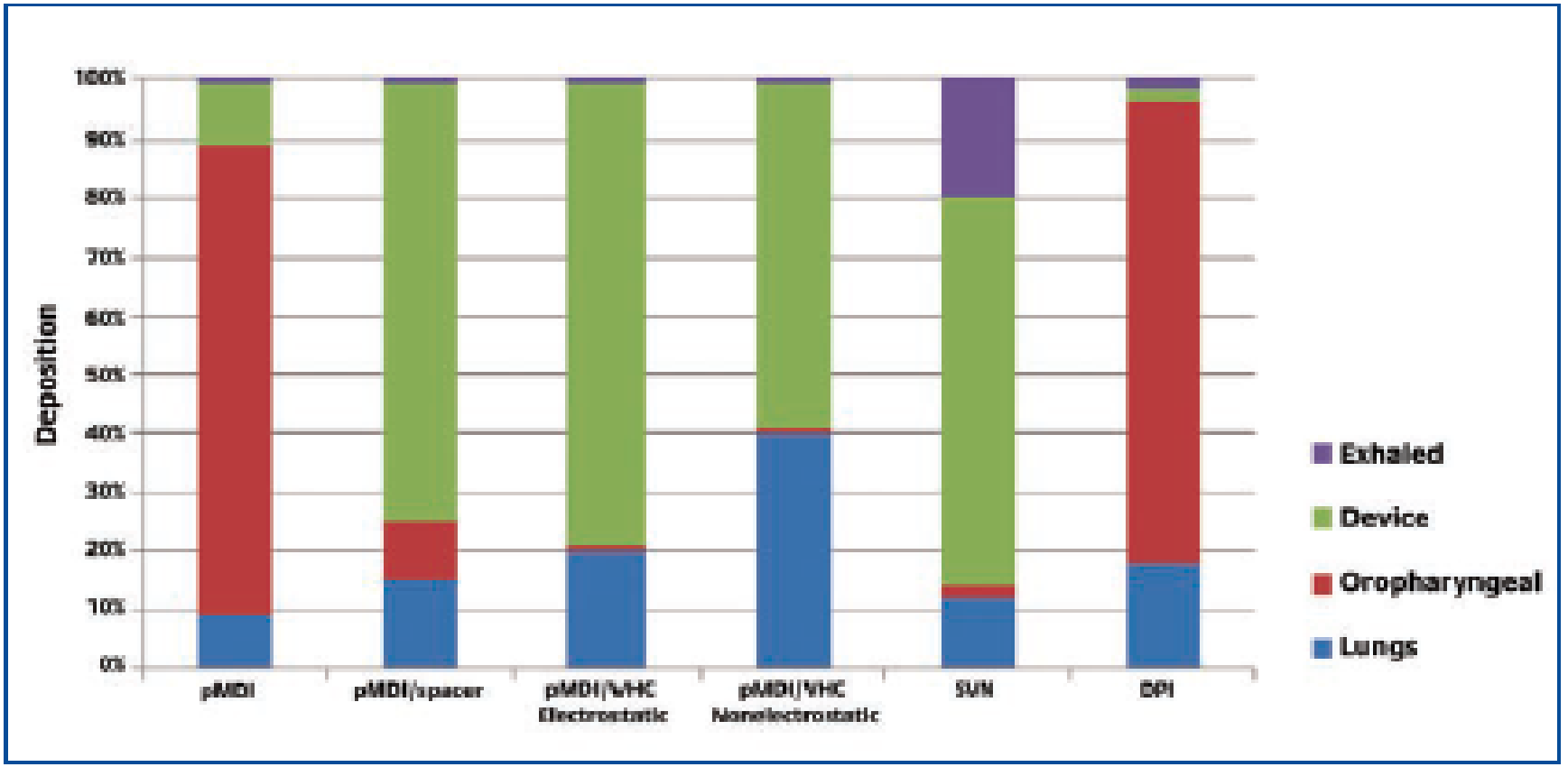


Figure 2. Drug deposition with common aerosol inhaler devices. Shown by color are the varying percentages of drug lung deposition and drug loss in the oropharynx, device, and exhaled breath.

pMDI = pressurized metered-dose inhaler; VHC = valved holding chamber; SVN = small-volume nebulizer; DPI = dry-powder inhaler

(Modified, with permission, from Reference 1 and Reference 7)

Pop quiz

- Of the three devices we just reviewed, which one is the best at delivering medication to the lungs?
  - pMDI, DPI, or SVN?

Endotracheal Tube

- Several medications can be administered through an endotracheal tube:
  - Lidocaine
  - Epinephrine
  - Ventolin
  - Atropine
  - Naloxone

Endotracheal Tube

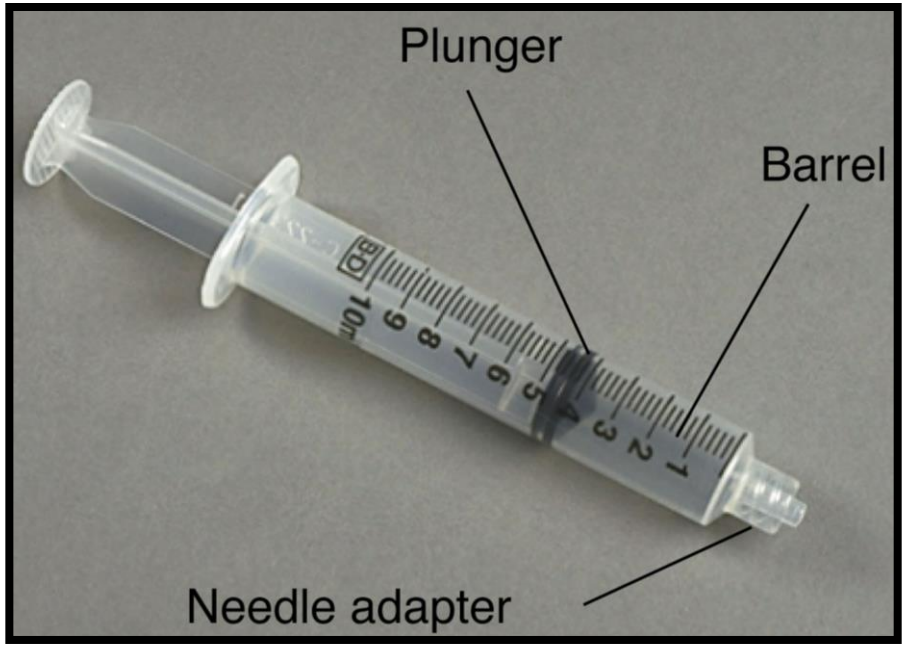
- "Compared with patients who received ACLS IV drug administration following out-of-hospital cardiac arrest, patients with intravenous access & drug administration had higher rates of short-term survival with no statistically significant improvement in survival to hospital discharge, quality of CPR, or long-term survival".
  - **Intravenous drug administration during out-of-hospital cardiac arrest: a randomized trial.** Olasveengen TM[1], Sunde K, Brunborg C, Thowsen J, Steen PA, Wik L. JAMA. 2009 Nov 25;302(20):2222-9. doi: 10.1001/jama.2009.1729

Endotracheal Tube

- "For our out-of-hospital advanced rescuer system, ET drugs at recommended doses (twice the IV dose) injected into an ET tube during cardiac arrest and CPR were of no benefit."
  - **Endotracheal drug administration during out-of-hospital resuscitation: where are the survivors?** Niemann JT, Stratton SJ, Cruz B, Lewis RJ. Resuscitation. 2002 May;53(2):153

Syringes and Needles

Syringe.



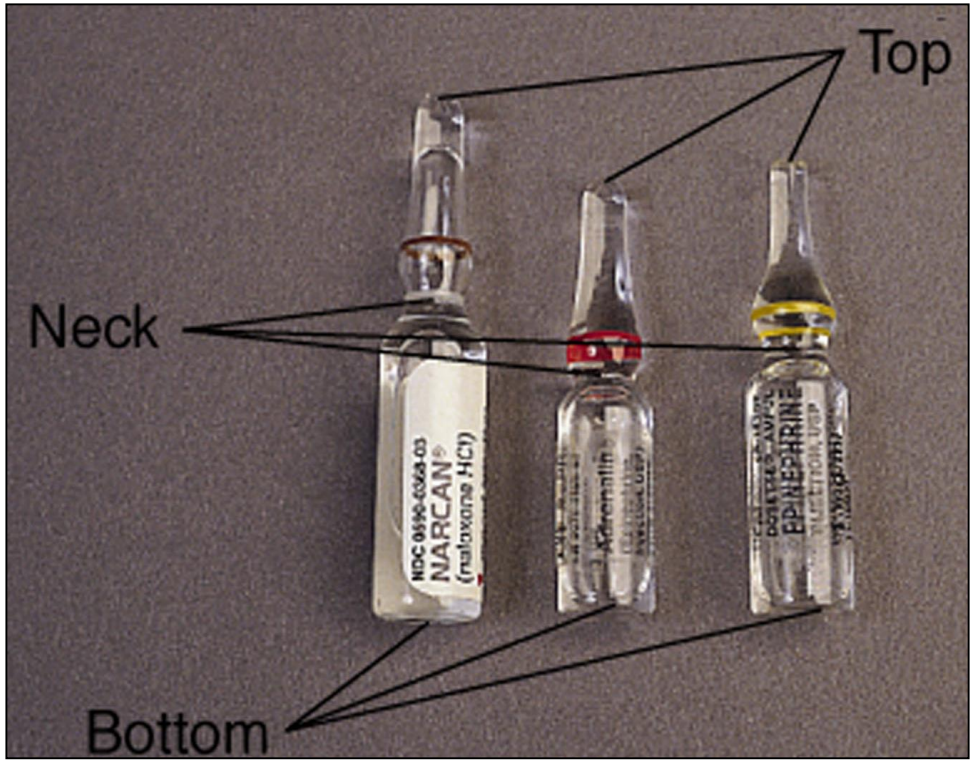
Hypodermic needle.

Parenteral Drug Containers

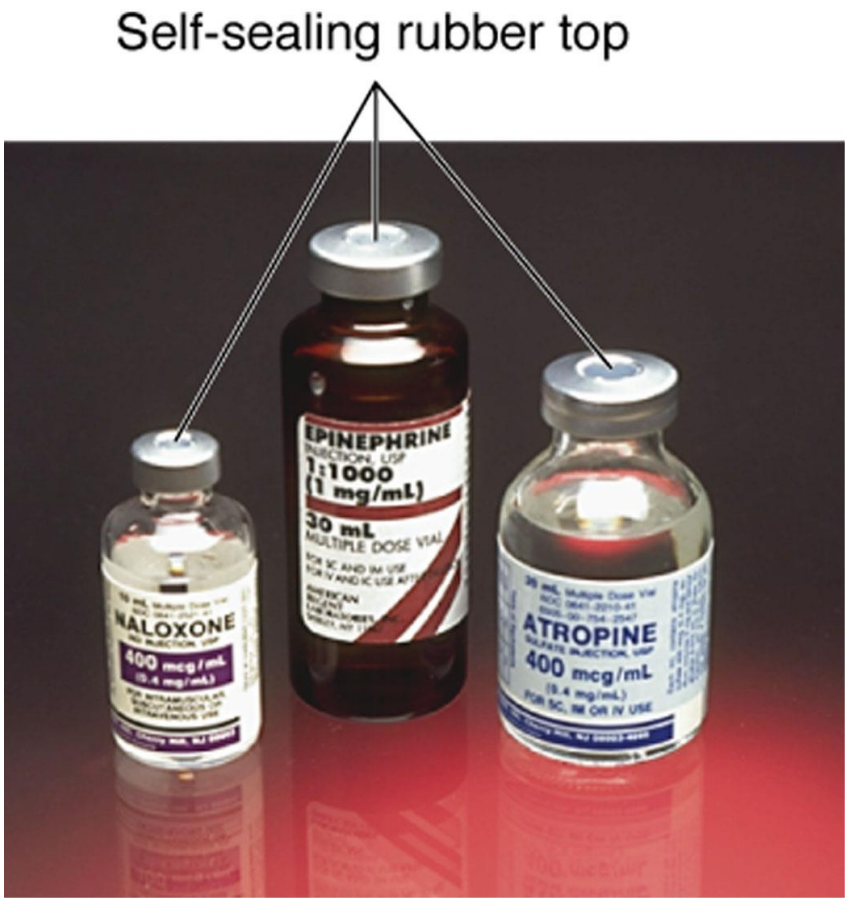
- Glass ampules
- Single and multidose vials
- Nonconstituted syringes
- Prefilled syringes
- Intravenous medication fluids

Ampules and Vials

Ampules.



Vials.



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Information On Drug Labels

- Name of medication
- Expiration date
- Total dose and concentration

Principles and Routes

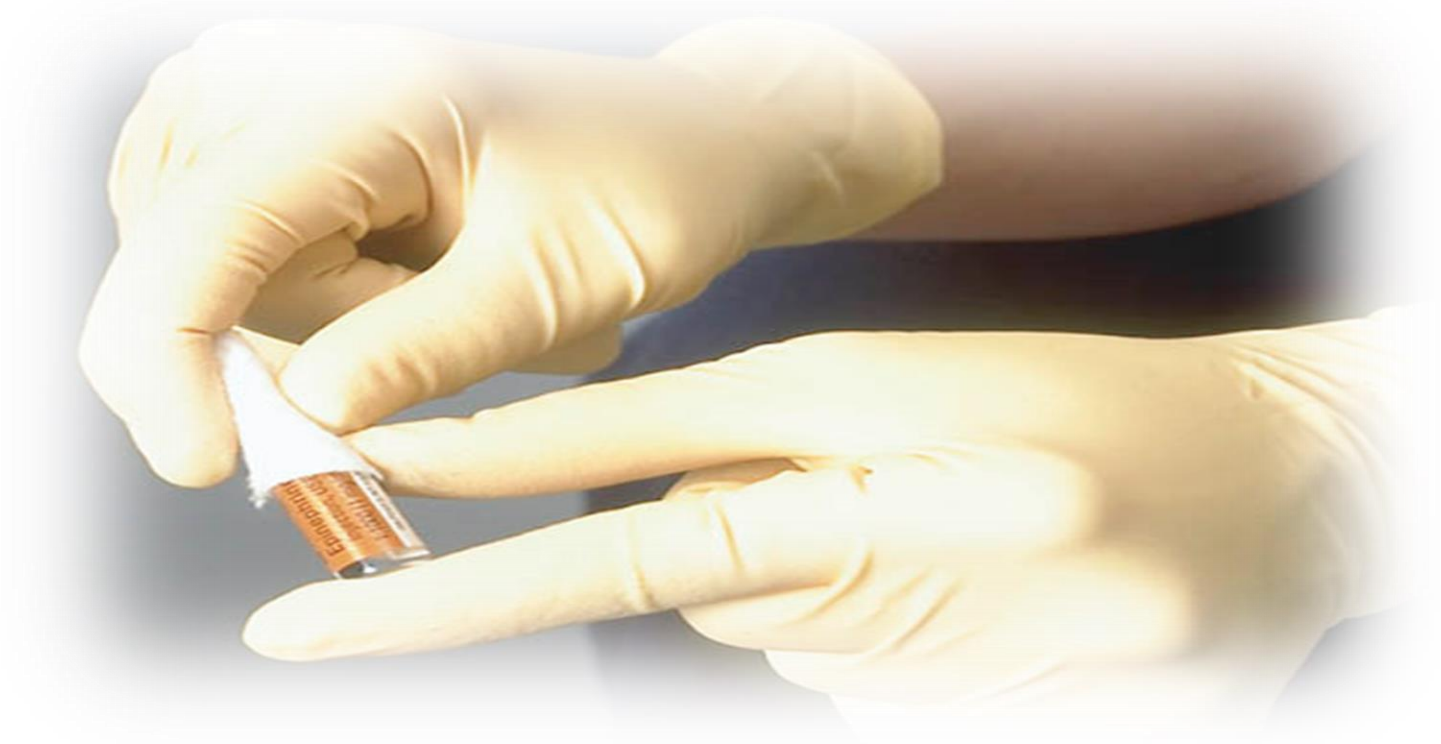
OBTAINING MEDICATION FROM A GLASS AMPULE

Obtaining Medication From a Glass Ampule

- Hold the ampule upright and tap its top to dislodge any trapped solution.

Obtaining Medication From a Glass Ampule

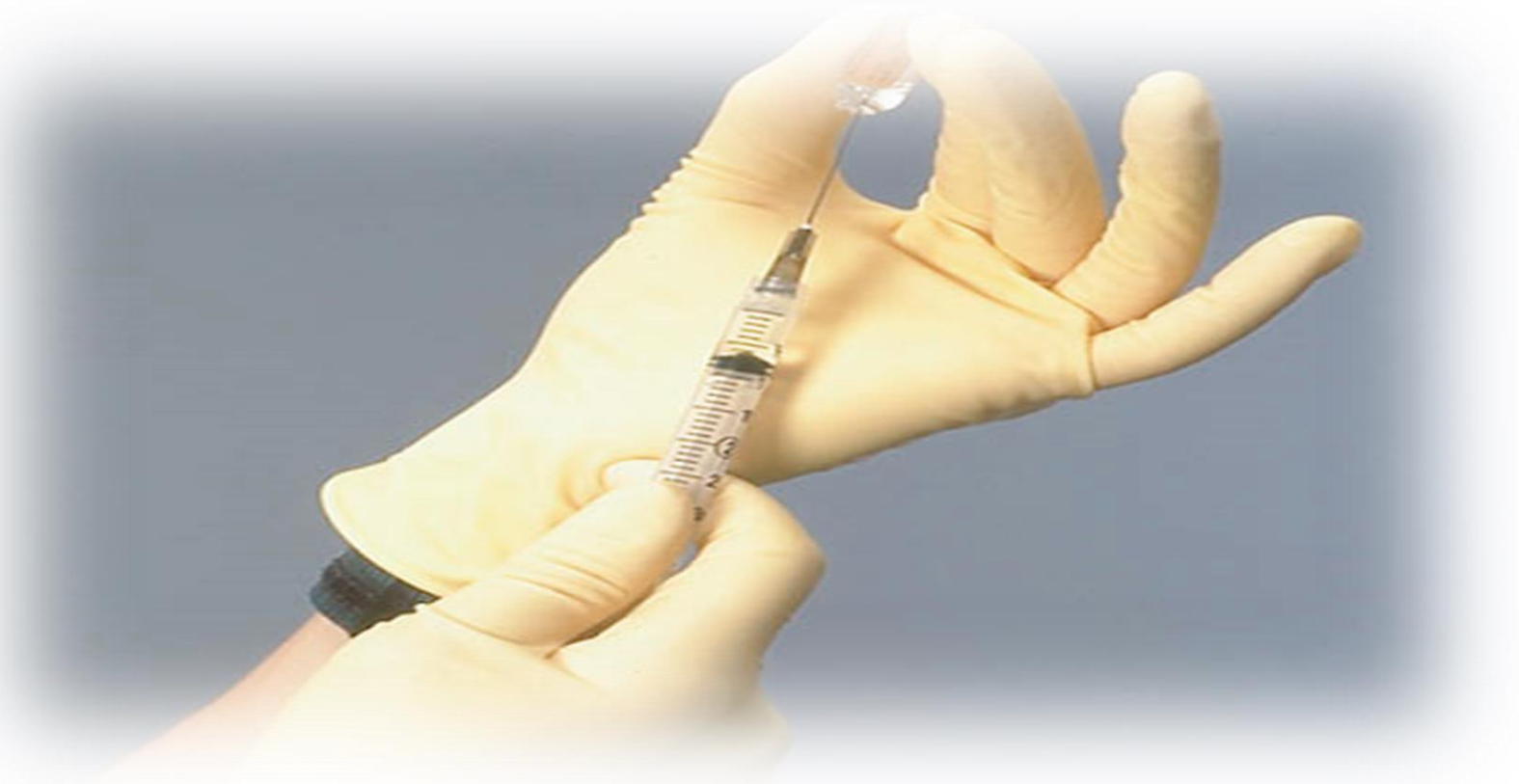
- Place gauze around the thin neck



Obtaining Medication From a Glass Ampule

- Snap it off with your thumb.

Draw Up the Medication



Obtaining Medication from a Vial

- Confirm the vial label.

Obtaining Medication from a Vial

- Prepare the syringe and hypodermic needle.

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Obtaining Medication from a Vial

- Cleanse the vial's rubber top

Obtaining Medication from a Vial

- Insert the hypodermic needle into the rubber top and inject the air from the syringe into the vial.

Principles and Routes

OBTAINING MEDICATION FROM A NON-CONSTITUTED DRUG VIAL

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Glucagon Kit

Obtaining Medication from a Non Constituted Drug Vial

- The non constituted drug vial actually consists of two vials, one containing a powdered medication and one containing a liquid mixing solution.

Obtaining Medication from a Non Constituted Drug Vial

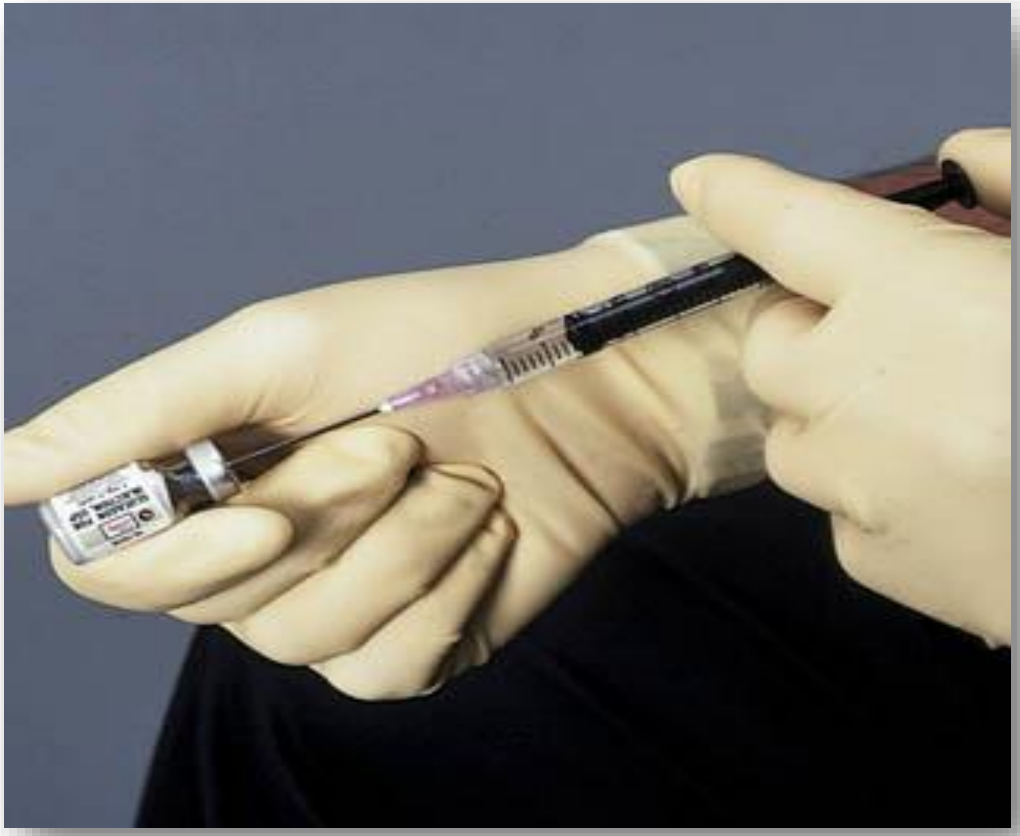
- Non constituted drugs come in separate vials. Confirm the labels.

Obtaining Medication from a Non Constituted Drug Vial

- Remove all solution from the vial containing the mixing solution.

Obtaining Medication from a Non Constituted Drug Vial

- Cleanse the top of the vial containing the powdered drug and inject the solution.



Obtaining Medication from a Non Constituted Drug Vial

- Agitate (do not shake) the vial to ensure complete mixture.

Obtaining Medication from a Non Constituted Drug Vial

- Prepare a new syringe and hypodermic needle.

Obtaining Medication from a Non Constituted Drug Vial

- Withdraw the appropriate volume of medication.

Obtaining Medication from a Non Constituted Drug Vial

- In the Mix-O-Vial system, the vials are joined at the neck. Confirm the labels.

Obtaining Medication from a Non Constituted Drug Vial

- Squeeze the vials together to break the seal. Agitate or shake to mix completely.

Obtaining Medication from a Non Constituted Drug Vial

- Withdraw the appropriate volume of medication.

Principles and Routes

PREFILLED OR PRELOADED SYRINGES

Prefilled or Preloaded Syringes

- Assemble the prefilled syringe
- Remove the pop off caps and screw together
- Reconfirm indication, drug, dose and route of administration
- Administer appropriately via the indicated route
- Properly dispose of the needle and syringe

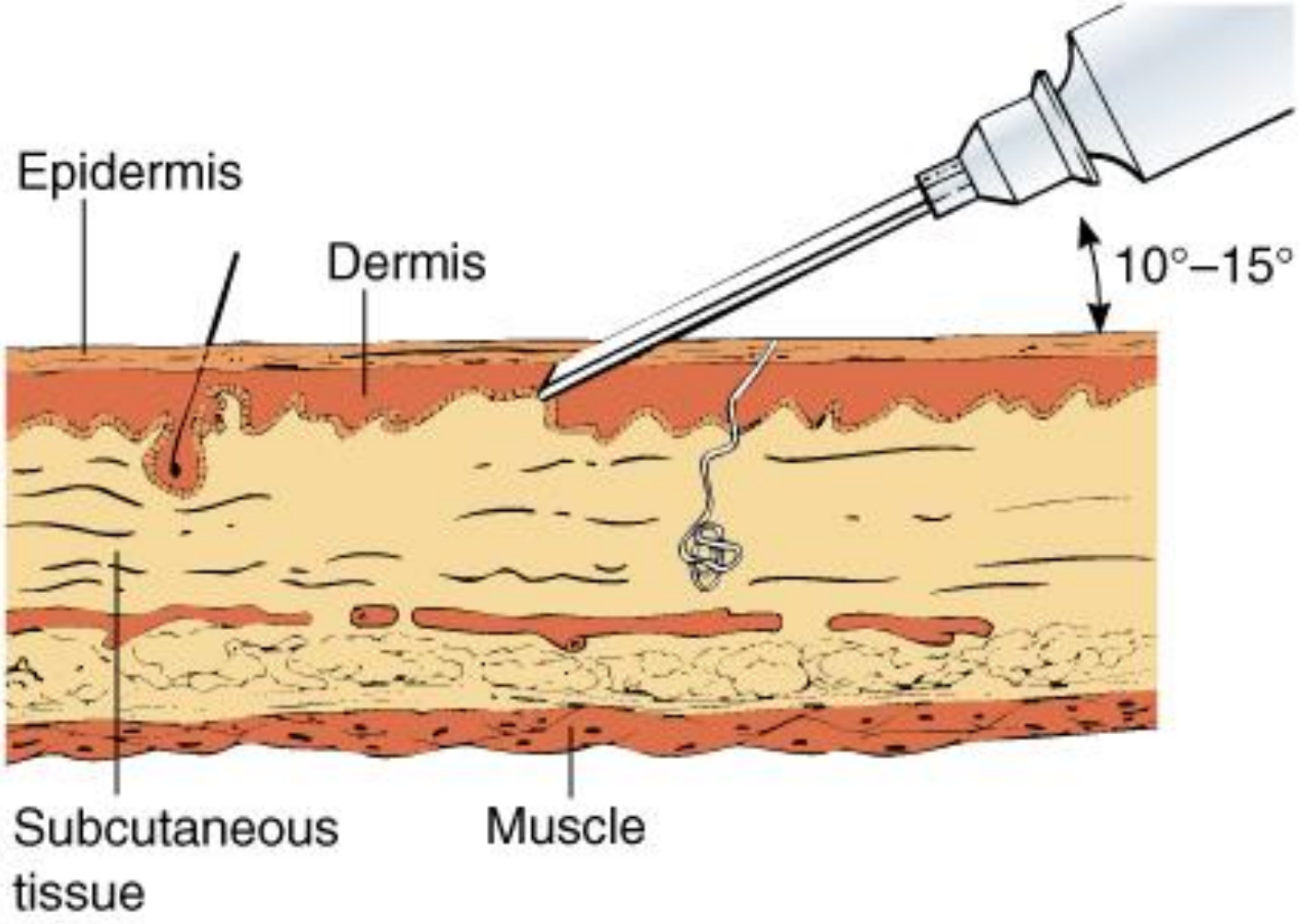
Principles and Routes

ROUTES OF ADMINSTRATION

Parenteral Routes

- Intradermal injection
- Subcutaneous injection
- Intramuscular injection
- Intravenous access
- Intraosseous infusion

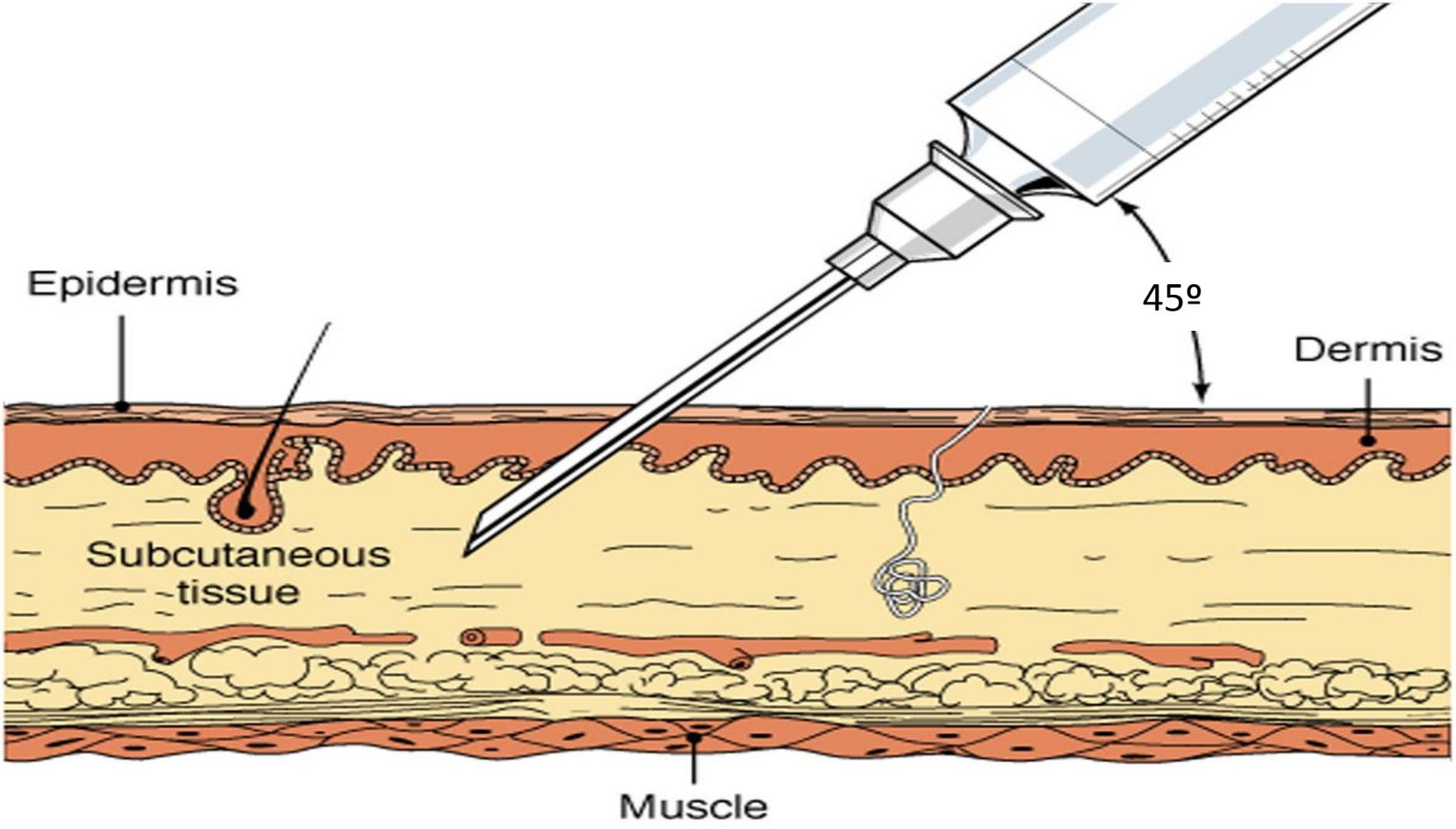
Intradermal Injection



Intradermal Injection Procedure

- Prepare the site with alcohol or betadine.
- Pull the patient's skin taut with your nondominant hand.
- Insert the needle, bevel up, just under the skin, at a 10-15 degree angle.
- Slowly inject the medication, look for a small bump, or wheal to form as medication is deposited and collects in the intradermal tissue.
- Remove the needle and dispose of it in the sharps container.
- Place the adhesive bandage over the site; use the gauze for hemorrhage control if needed.

Subcutaneous Injection



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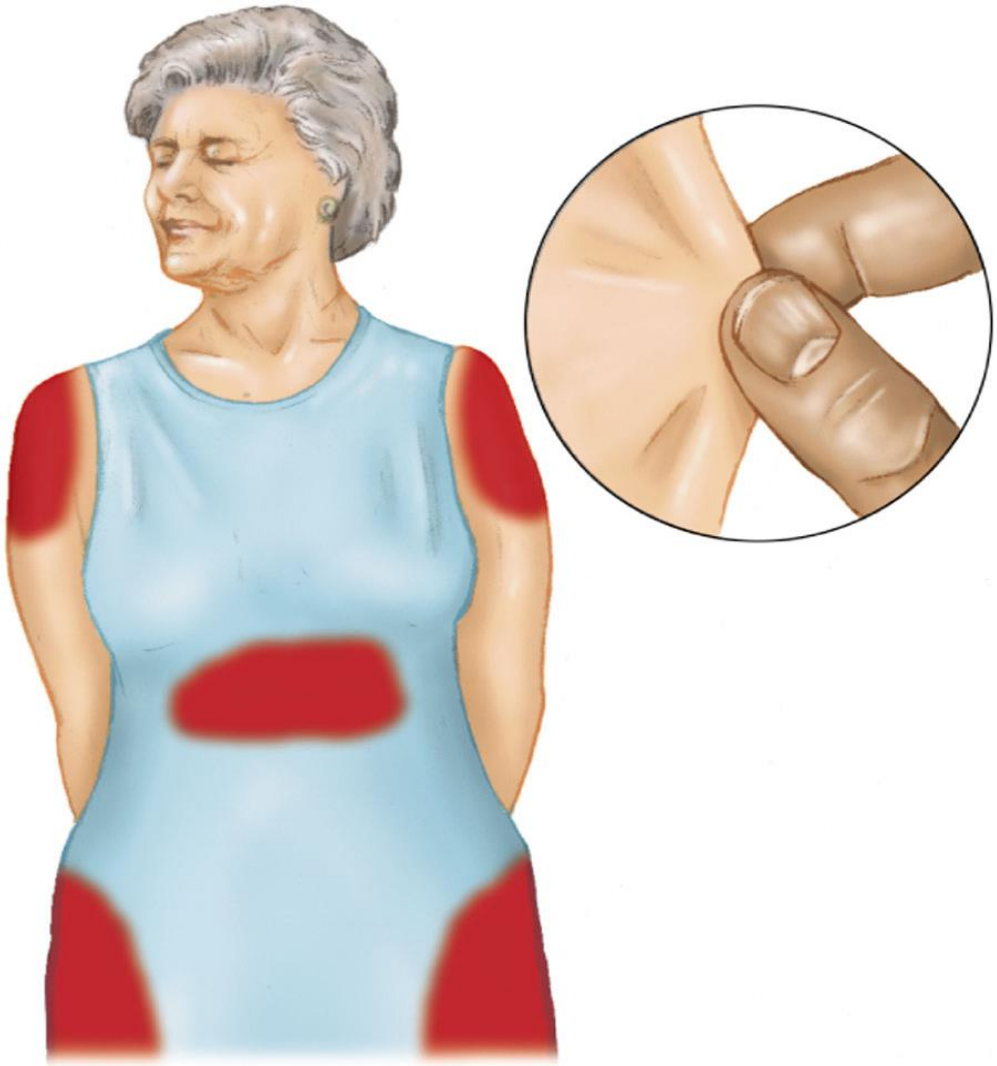
Subcutaneous Injection Sites

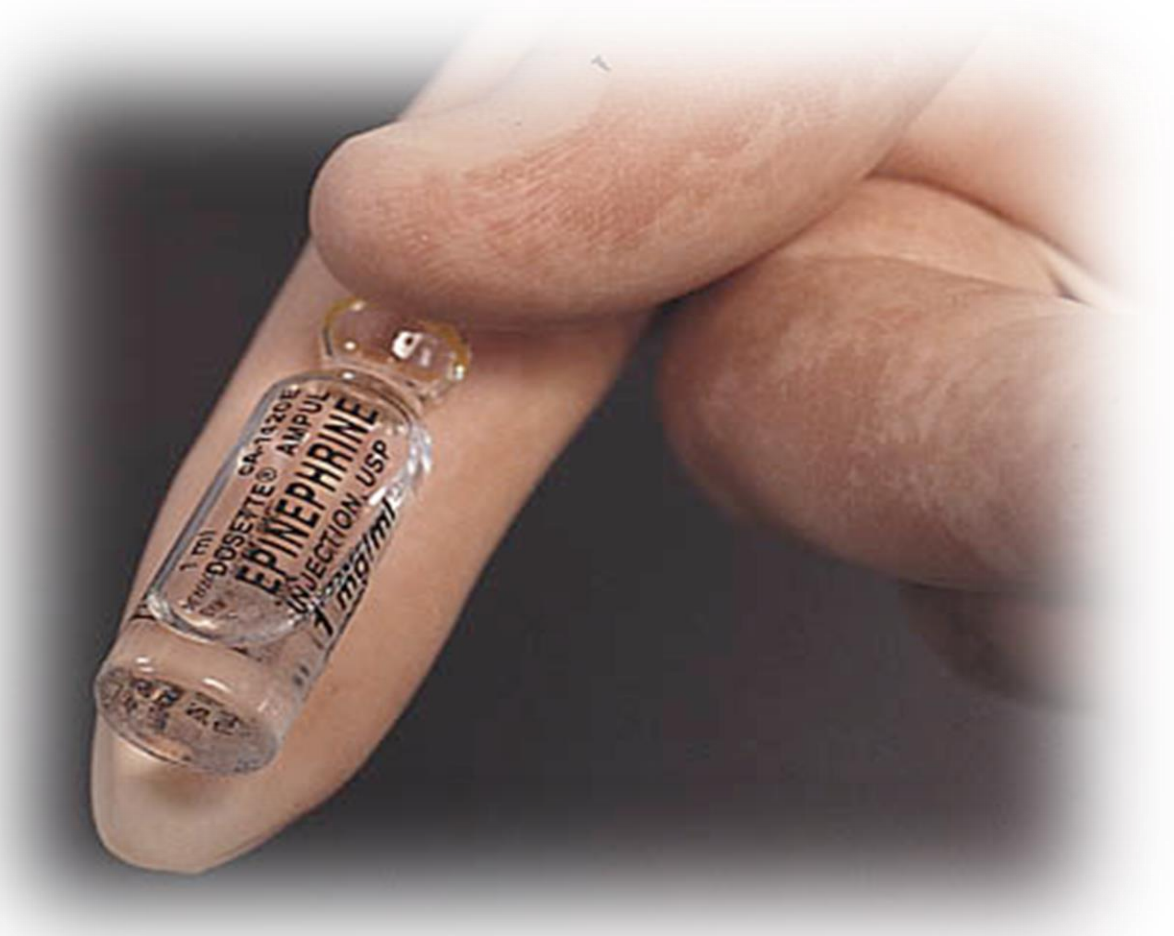


Subcutaneous Injections

- Prepare the Equipment

Subcutaneous Injections

- Check the Medication



Subcutaneous Injections

- Draw up the Medication

Subcutaneous Injections

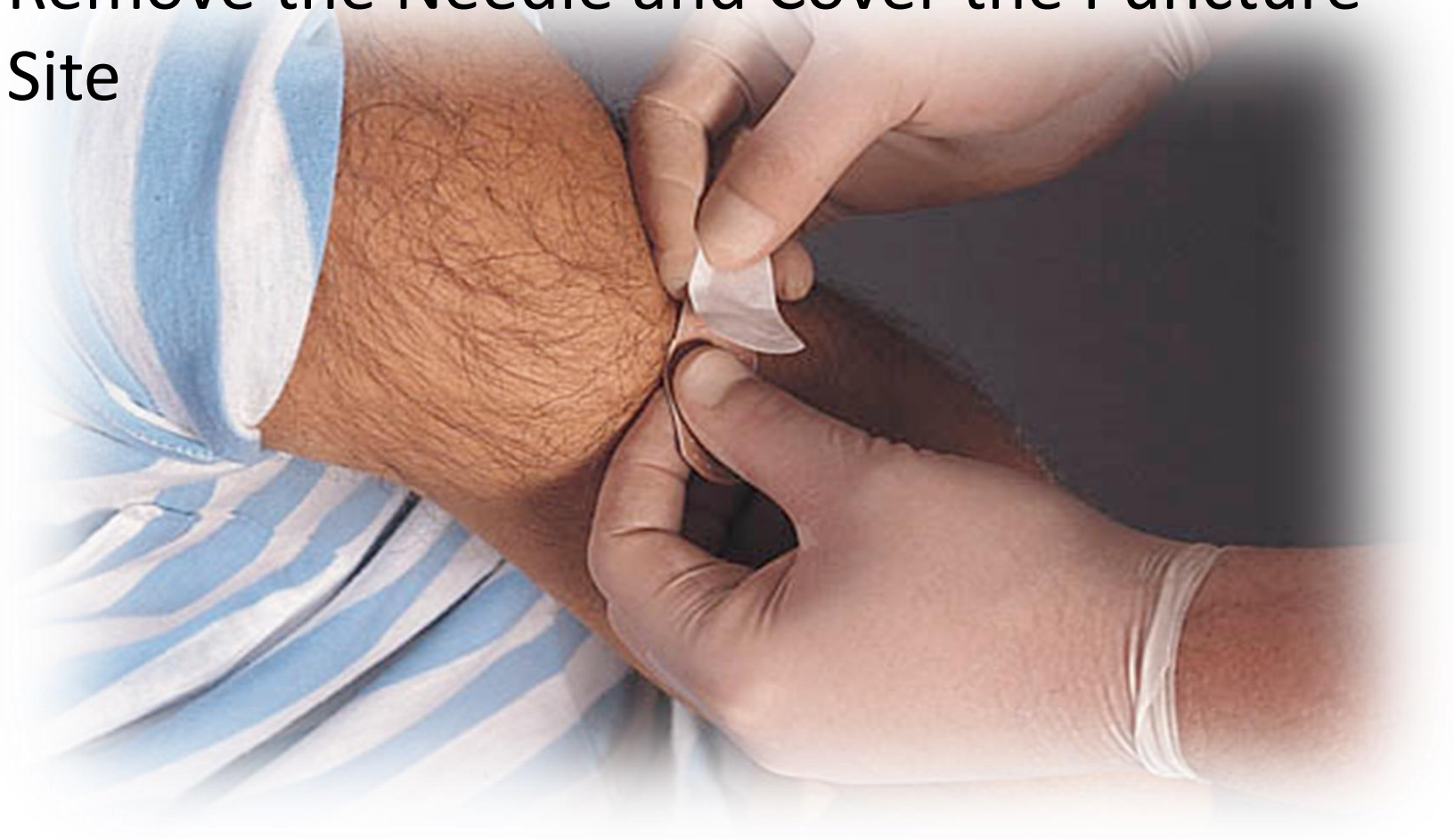
- Prep the Site

Subcutaneous Injections

- Insert the Needle at a 45° Angle

Subcutaneous Injections

- Remove the Needle and Cover the Puncture Site



Subcutaneous Injections

- Monitor the patient

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Intramuscular Injection Sites

- Deltoid
- Dorsal gluteal
- Vastus lateralis
- Rectus femoris

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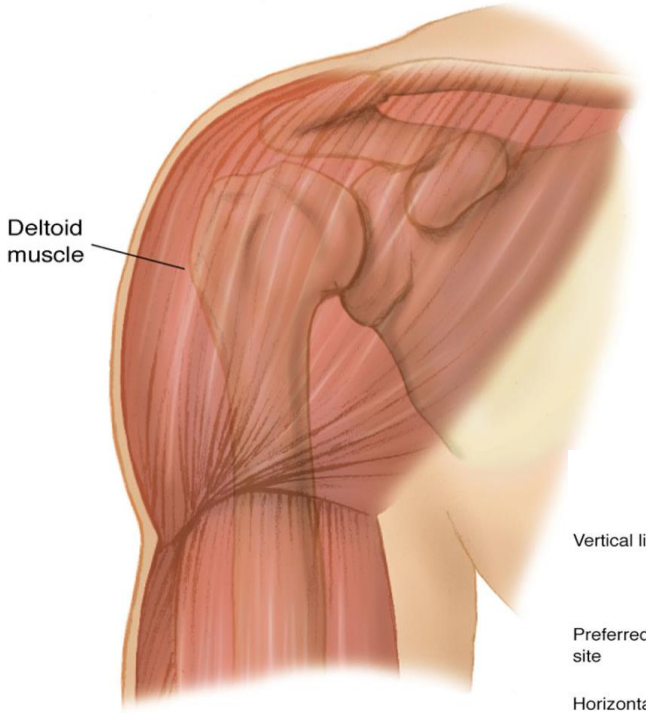
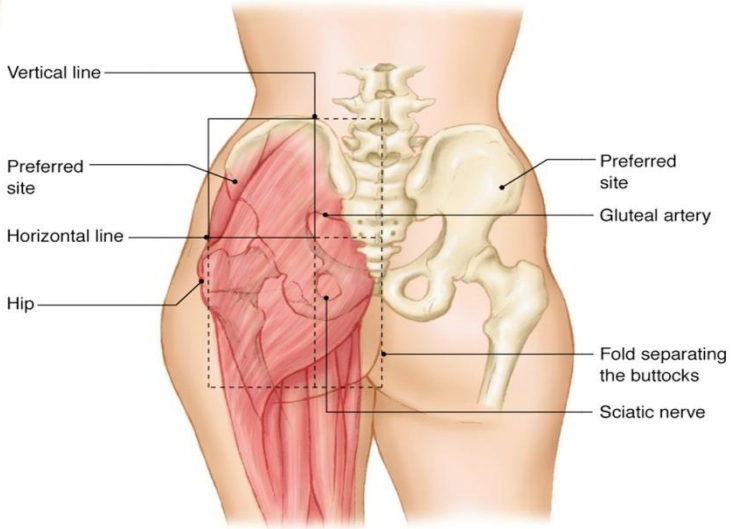
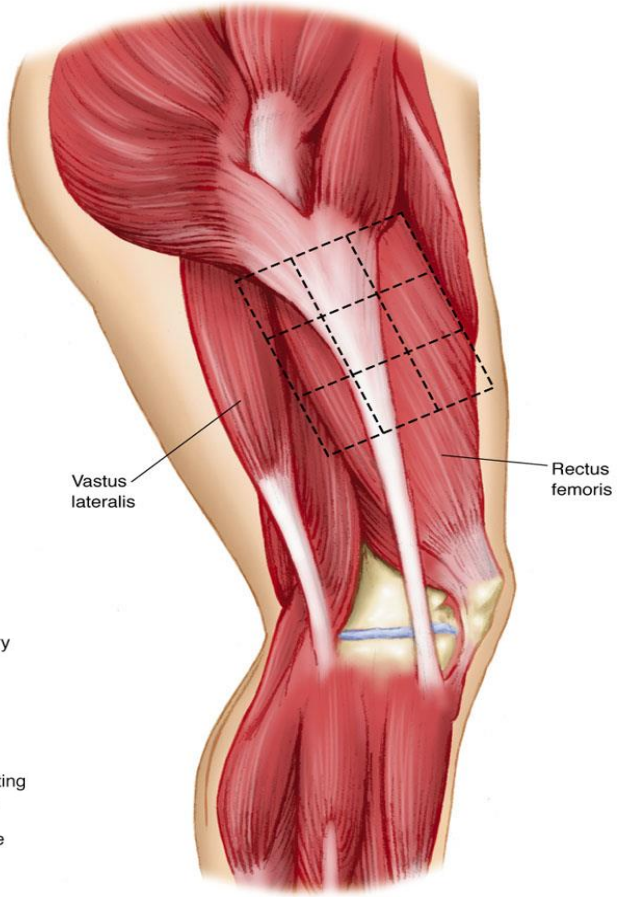
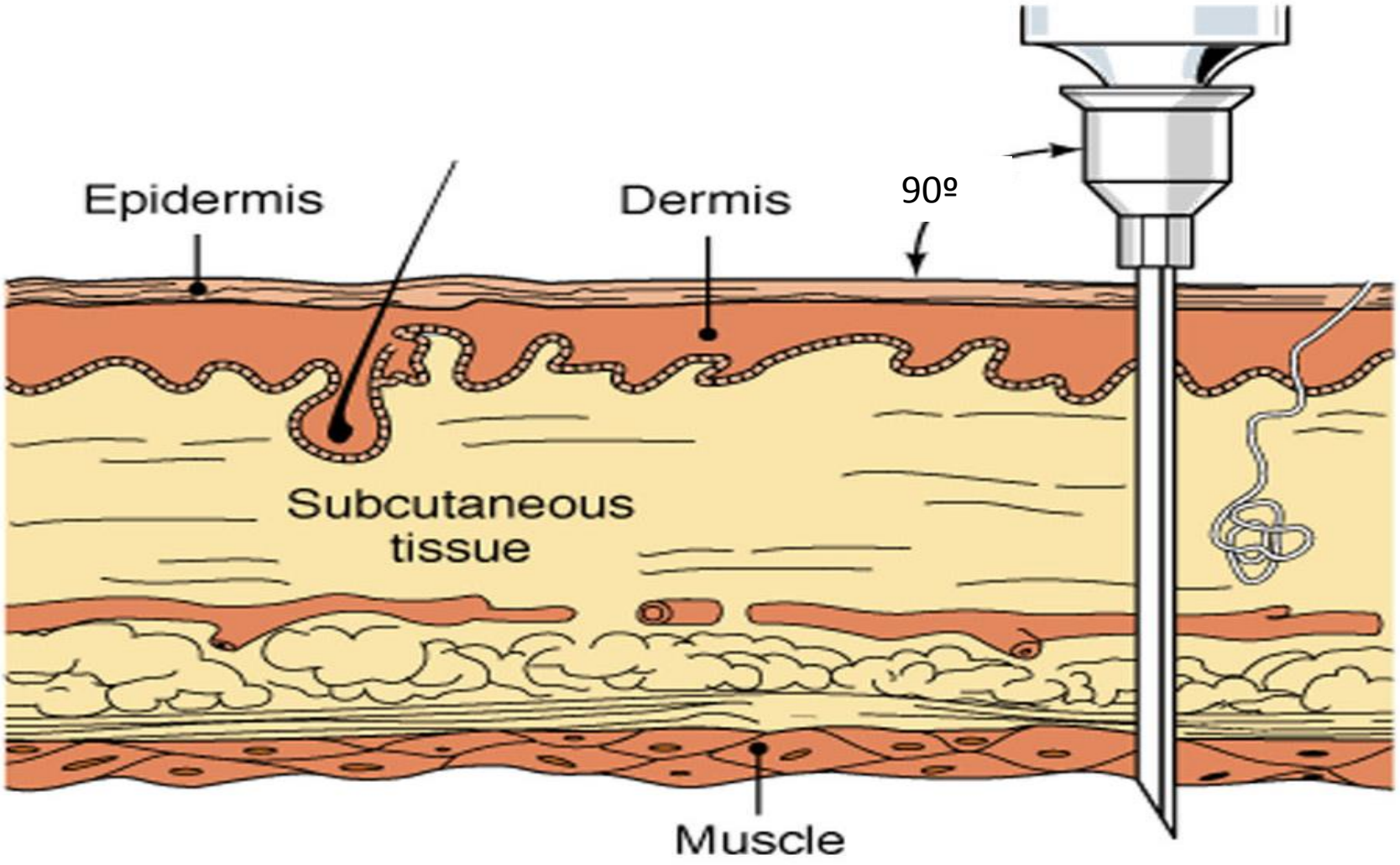
Intramuscular Injection Sites







Intramuscular Injection



Intramuscular Injection

- Prepare the Equipment.

Intramuscular Injection

- Check the Medication

Intramuscular Injection

- Draw up the Medication

Intramuscular Injection

- Prepare the site

Intramuscular Injection

- Insert the needle at a 90° angle

Intramuscular Injection

- Remove the needle and cover the puncture site

Intramuscular Injection

- Monitor the patient

Summary

- Regardless of the governing body, it is the responsibility of the Paramedic to fully understand the medication they are going to be administering.
- The paramedic must provide the patient with all pertinent information with regards to the medication.
- It is the duty of the paramedic to know the indications, contraindications, dosages, routes of administration, side effects and safe handling techniques for all required medications.

References

- Intravenous drug administration during out-of-hospital cardiac arrest: a randomized trial. Olasveengen TM, Sunde K, Brunborg C, Thowsen J, Steen PA, Wik L. JAMA. 2009 Nov 25;302(20):2222-9. doi: 10.1001/jama.2009.1729
- Endotracheal drug administration during out-of-hospital resuscitation: where are the survivors? Niemann JT, Stratton SJ, Cruz B, Lewis RJ. Resuscitation. 2002 May;53(2):153
- Ari, A. et al. A Guide to Aerosol Delivery Devices for Respiratory Therapists, 2nd edition. Copyright 2009 by the American Association for Respiratory Care.
- Washington, N. et al. Physiological Pharmaceutics, Barriers to Drug Absorption. 2nd edition. 2001.