

Medication Delivery

Pea Ridge Fire Department

EMS refresher



Introduction

- Vascular access may be needed for patients in hemodynamically unstable condition.
 - Many techniques are used.
 - Patient's survival depends on your abilities.

Ensuring Safe Medication Administration

- Ensure medications are administered accurately and safely.
 - Use standing orders or online medical direction.
 - Avoid human factors that cause errors.
 - Follow the 10 rights of medication administration.

Ensuring Safe Medication Administration

- Use a tool to verify:
 - Dose
 - Drug name
 - Route
 - Rate of administration
 - Indication for administration
 - Contraindications
 - Drug concentration
 - Volume to be administered

Ensuring Safe Medication Administration

- Document:
 - Dose administered
 - Name of medication
 - Route
 - Rate
 - Time of administration
 - Who administered the drug
 - Patient's response

Local Drug Distribution System

- Ensure all equipment on the ambulance is functional at the beginning of your shift.
 - Check that medications are:
 - Not expired
 - Not damaged
 - Readily available in right quantity
 - You are responsible for documentation and security of all controlled substances.

Medical Asepsis

- Practice of preventing contamination of the patient using aseptic technique
 - Accomplished through:
 - Sterilization of equipment
 - Antiseptics
 - Disinfectants

Medical Asepsis

- Clean technique versus sterile technique
 - Sterile technique: Deconstruction of all living organisms using heat, gas, or chemicals
 - For a sterile field to exist:
 - Wear sterile sleeves or a gown.
 - Wear sterile gloves.
 - Place sterile drapes around procedural area.

Medical Asepsis

- May not be possible to maintain a sterile environment in the field.
 - Practice medical asepsis to reduce risk of contamination and infection.
 - Handwashing, wearing gloves, keeping equipment as clean as possible

Medical Asepsis

- Antiseptics and disinfectants
 - Antiseptics are used before invasive procedure.
 - Disinfectants are toxic to living tissue.

Standard Precautions and Contaminated Equipment Disposal

- Standard precautions
 - Treat any bodily fluid as being potentially infectious.

Standard Precautions and Contaminated Equipment Disposal

- Disposal of contaminated equipment
 - After an IV catheter or needle has penetrated a patient's skin, it is contaminated.

Table 14-1

Minimizing Your Risk of a Needlestick

Use blunt-tip needles when drawing medication from vials or infusing medications directly into an IV solution.

Use a needleless delivery system. Needleless delivery systems “recap” themselves, which greatly reduces the risk of a needlestick.

Immediately dispose of all sharps in a puncture-proof sharps container. *Do not* drop the sharps on the floor for later disposal, and *do not* attempt to recap a needle and syringe before placing it in the sharps container. Even if you use a needle or IV line that automatically retracts, you still must discard it in a sharps container.

When possible, perform all invasive procedures at the scene. If your patient's condition warrants starting an IV line or administering a medication en route to the hospital, then *use extreme caution*. Although most paramedics become proficient at starting IV lines in the back of a moving ambulance, it may be necessary to have your partner briefly stop the ambulance, especially if you are traveling over rough terrain.

Recap needles *only* as an absolute last resort. If you must recap a needle, then use the one-handed technique: Place the needle cover on a stationary surface, then slide the needle—with one hand—into the needle cap.

Abbreviation: IV, intravenous

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Standard Precautions and Contaminated Equipment Disposal

- Immediately dispose of all sharps in a sharps container.
 - Place at least two in the back of the ambulance.
 - Have a small one in your jump kit.



IV Fluid Composition

- Operation of electrolytes
 - A patient's electrolytes can become altered from:
 - Excessive vomiting
 - Diarrhea
 - Dietary issues
 - Medications
 - Blood loss, or a variety of other injuries

IV Fluid Composition

Table 14-2 **Electrolyte Composition of Intravenous Fluids**

Fluid	Sodium (Na)	Chloride (Cl)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)
Human plasma	135–145	95–105	3.5–5	8–10.5	1.5–2.5
0.45% sodium chloride	77	77	0	0	0
0.9% sodium chloride	154	154	0	0	0
3.0% sodium chloride	513	513	0	0	0
Lactated Ringer	130	109	4	3	0

All values are represented as milliequivalents per liter.

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Types of IV Solutions

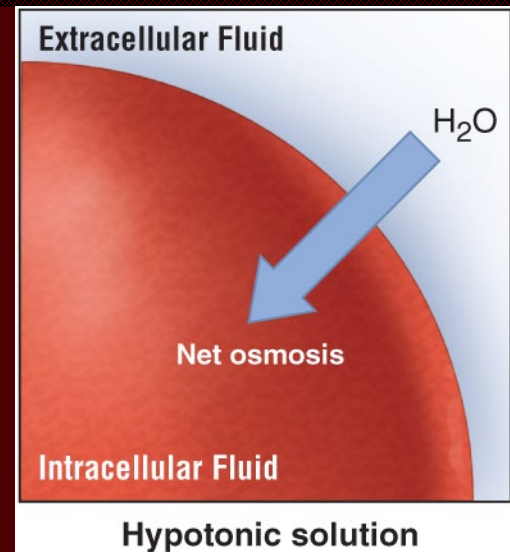
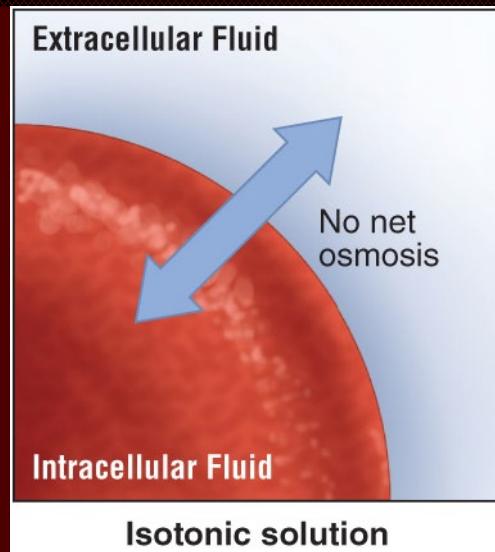
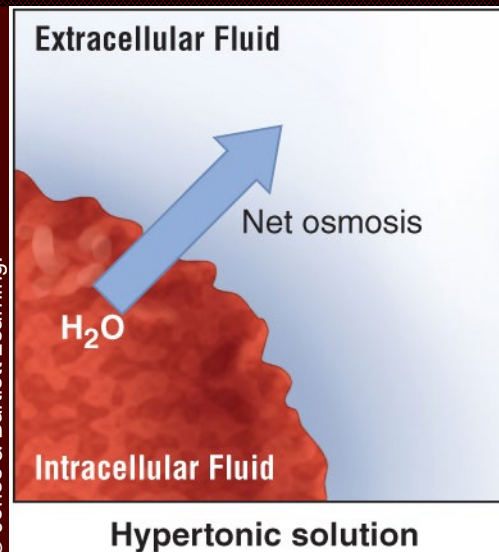
- Crystalloid solutions
 - Dissolved crystals in water
 - Can cross membranes and alter fluid levels
 - 3-to-1 replacement rule
 - Cannot carry oxygen
 - Boluses should be given to maintain perfusion, not to raise blood pressure.

Types of IV Solutions

- Colloid solutions
 - Contain molecules that are too large to pass out of capillary membranes
 - Molecules remain in the vascular compartment.
 - High osmolarity
 - Could cause dramatic fluid shifts
 - Short duration of action

Types of IV Solutions

- IV solutions are categorized by their tonicity.
 - Isotonic
 - Hypertonic
 - Hypotonic



Types of IV Solutions

- Isotonic solutions
 - Examples:
 - Lactated Ringer's (LR) solution
 - D₅W, 5% dextrose in water

Types of IV Solutions

- Hypotonic solutions
 - Hydrate the cells while depleting the vascular compartment
 - Can cause sudden fluid shift from intravascular space to the cells

Types of IV Solutions

- Hypertonic solution
 - Pulls fluid from intracellular and intestinal compartments to intravascular compartment
 - Help stabilize blood pressure, increase urine output, and reduce edema
 - Careful monitoring to avoid fluid overloading

Types of IV Solutions

- Oxygen-carrying solutions
 - Whole blood is the best replacement for lost blood.
 - Synthetic blood substitutes are being researched.

Techniques and Administration

- IV therapy involves cannulation of a vein with a catheter.
 - Peripheral vein cannulation involves cannulating veins of the periphery.
 - Keep the IV equipment sterile!

Techniques and Administration

- Assembling your equipment
 - Gather and prepare in advance
 - Elastic tourniquet
 - Cleaning wipe or solution
 - Gauze
 - Tape or adhesive bandage
 - Appropriate size IV catheter
 - IV administration set



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Techniques and Administration

- Choosing an IV solution
 - Usually limited to normal saline and LR solution
 - IV solution bags must be used within 24 hours once opened.
 - IV bags come in different fluid volumes.



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Techniques and Administration

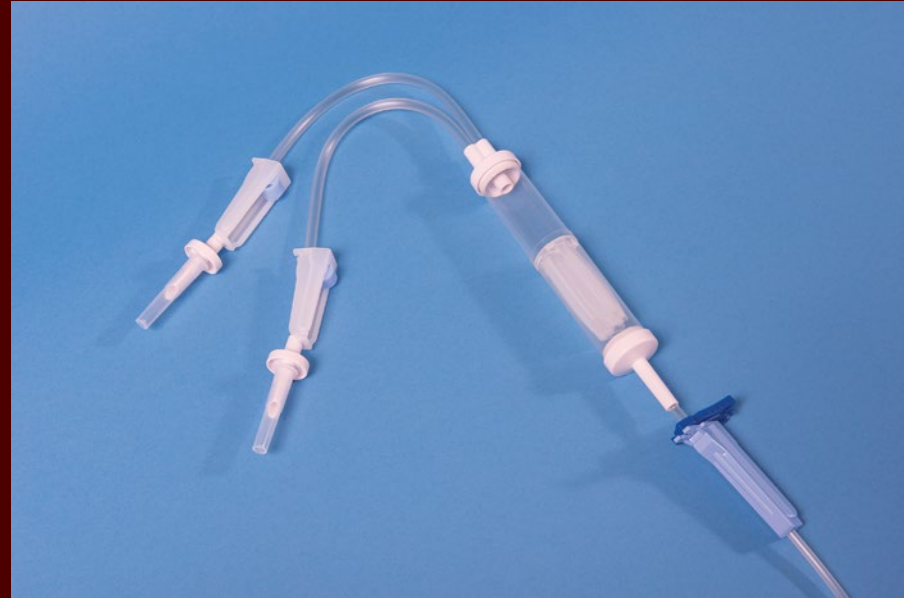


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- Choosing an administration set
 - Must be used once piercing spike is exposed
 - Two sizes
 - Microdrip set: 60 gtt/mL
 - Macro drip set: 10 or 15 gtt/mL

Techniques and Administration

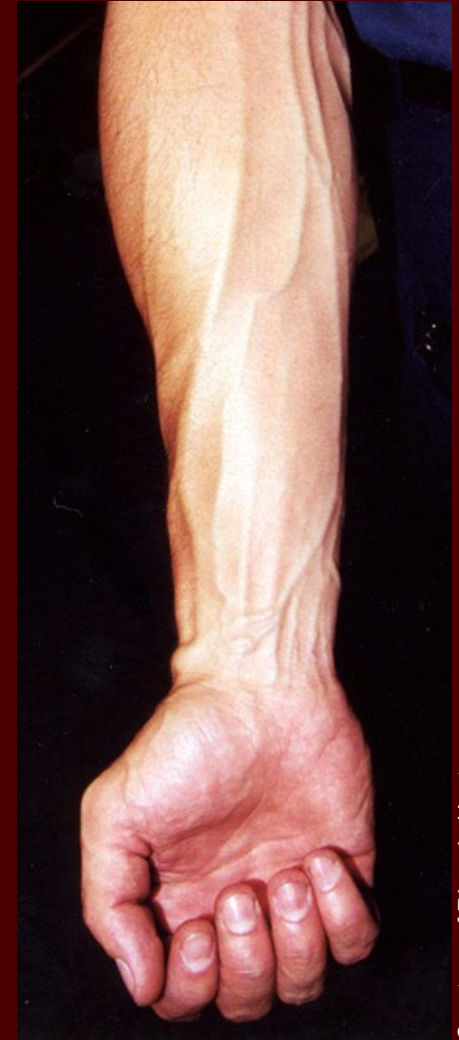
- Preparing an administration set
 - Verify the expiration date and check the solution.
- Other administration sets
 - Blood tubing
 - Volutrol



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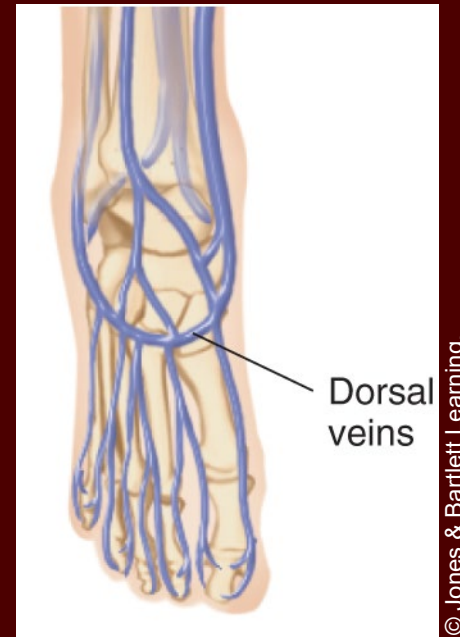
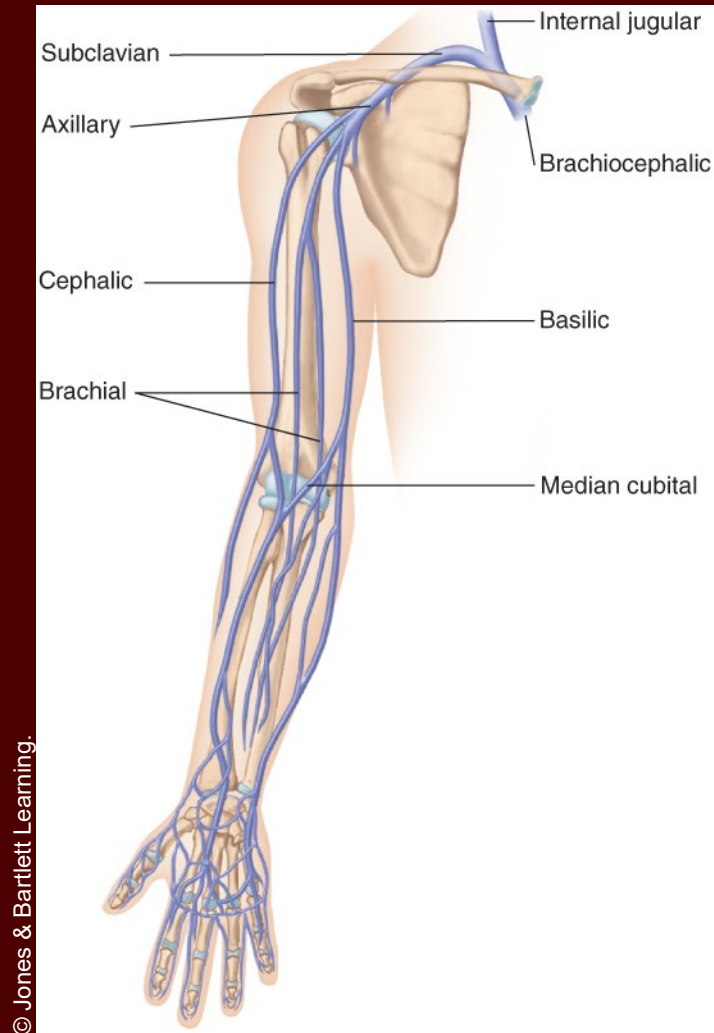
Techniques and Administration

- Choosing an IV site
 - Avoid areas that contain valves and bifurcations.
 - Locate vein that looks straightest, firm, round, and springs when palpated.
 - Limit IV access to distal areas of extremities.



Courtesy of Rhonda Hunt.

Techniques and Administration



Techniques and Administration



Courtesy of Rhonda Hunt.

- Choosing an IV site (cont'd)
 - Bulging veins can roll from side to side.
 - Pull skin over vein taut with thumb of free hand.
 - Flex patient's hand.
 - Stabilize wrist.

Techniques and Administration

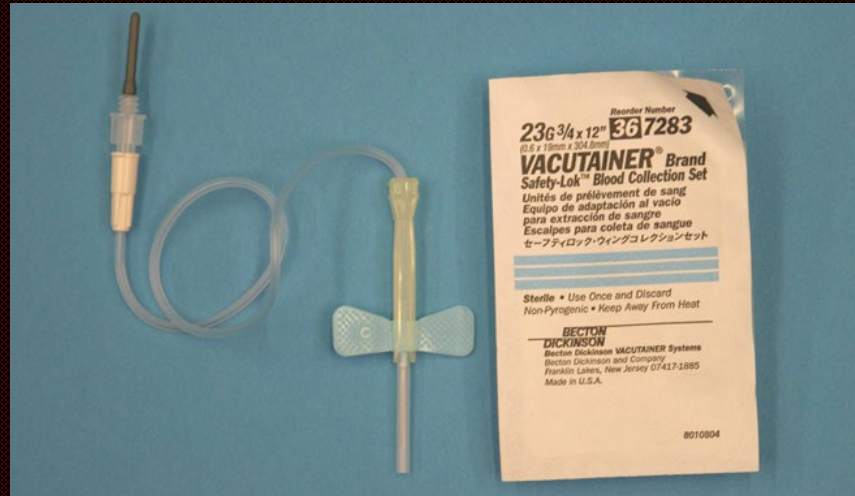
- Choosing an IV site (cont'd)
 - Consider the patient's opinion.
 - Avoid extremity if it shows signs of:
 - Trauma
 - Injury
 - Infection
 - Some protocols allow IV cannulation of leg veins.

Techniques and Administration

- Choosing an IV catheter
 - Over-the-needle
 - Butterfly
 - Intracatheter



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Techniques and Administration

- Choosing an IV catheter (cont'd)
 - Newer needles retract.
 - Choose largest diameter catheter for vein.

Techniques and Administration

- Inserting the IV catheter
 - Keep the beveled side up.
 - Maintain adequate traction.
 - Use a constricting band above the site.
 - Remove the band while assembling IV equipment.



Courtesy of Rhonda Hunt.

Techniques and Administration

- Inserting the IV catheter (cont'd)
 - Most common constricting band is a latex-free IV tourniquet.
 - Stops only venous flow
 - If visualizing or palpating IV site is difficult:
 - Use a device that applies more pressure.

Techniques and Administration

- Inserting the IV catheter (cont'd)
 - Prep site.
 - Apply lateral traction, while holding catheter bevel side up.
 - Insert at a 45° angle.
 - Push through the skin until the vein is pierced.



Courtesy of Rhonda Hunt.

Techniques and Administration

- Inserting the IV catheter (cont'd)
 - Drop angle to 15° and advance catheter a few centimeters.
 - Slide sheath off needle into vein.
 - Apply pressure to the vein.
 - Remove needle.
 - Dispose needle in sharps container.

Techniques and Administration

- Securing the line
 - Tape the area to secure the catheter and tubing.
 - Cover the site with sterile gauze and secure with tape.



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Techniques and Administration

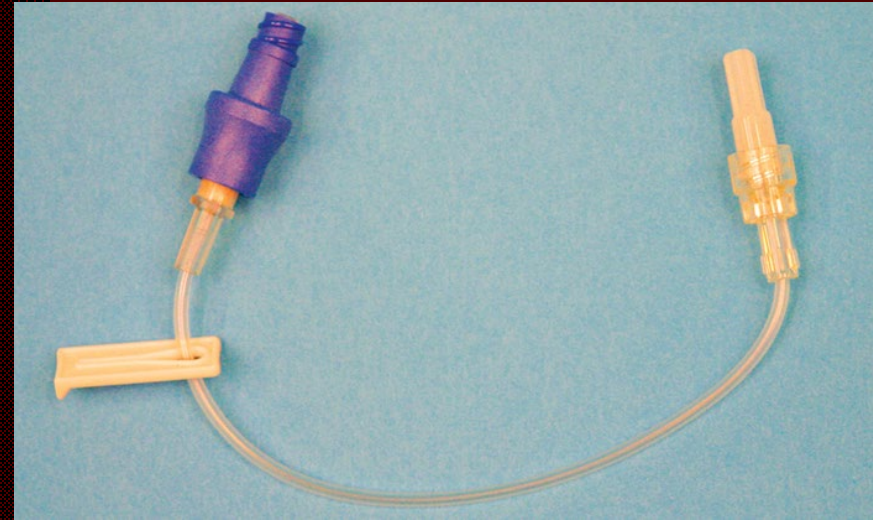
- Discontinuing the IV line
 - Shut off the flow.
 - Peel tape back.
 - Stabilize the catheter.
 - Do not remove IV tubing from hub.
 - Pull catheter and IV line from patient's vein.
 - Apply pressure.



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Alternative IV Sites and Techniques

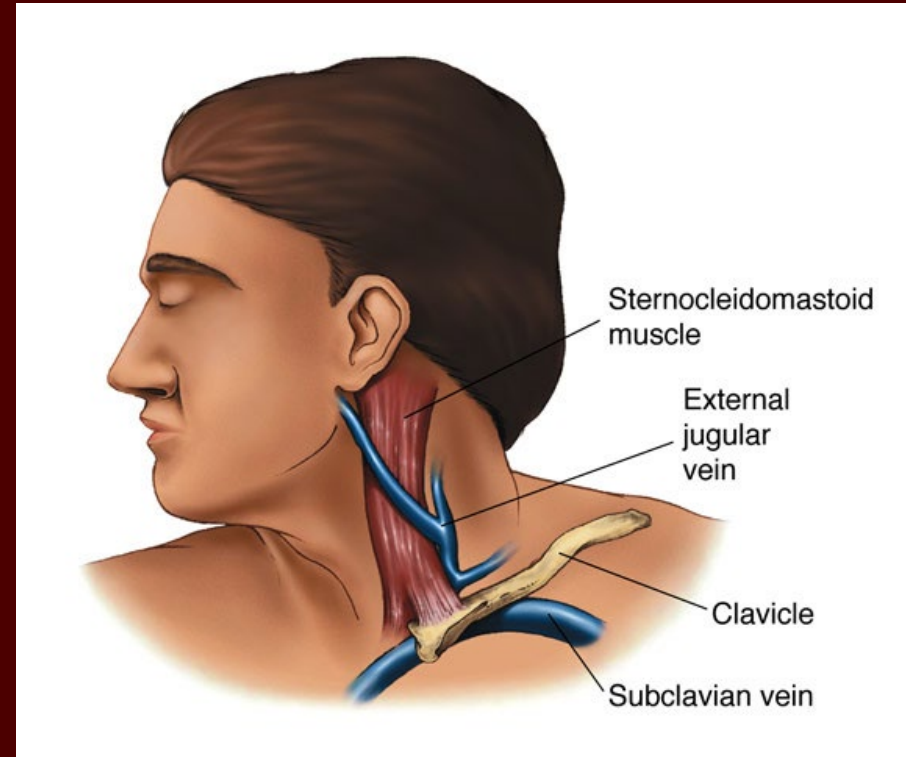
- Saline locks
 - Maintain active IV site without running fluids through vein
 - Attached to end of IV catheter
 - Filled with approximately 2 mL of saline
 - Also called intermittent sites (INT)



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Alternative IV Sites and Techniques

- EJ vein cannulation
 - EJ vein runs behind jaw.
 - Large and easy to cannulate
 - Exhaust all other means before cannulation.



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Alternative IV Sites and Techniques

- EJ vein cannulation (cont'd)
 - Place patient in supine, head-down position.
 - Turn head to opposite side of intended venipuncture.
 - Feel carefully for a pulse.
 - Cleanse the site.
 - Occlude with your finger.



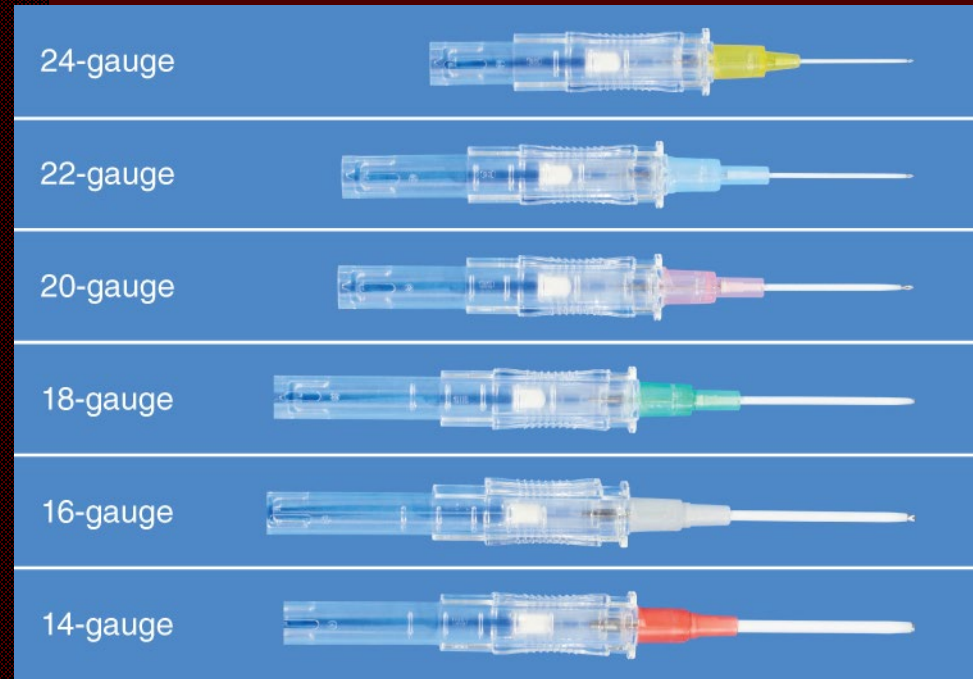
Courtesy of Rhonda Hunt.

Alternative IV Sites and Techniques

- EJ vein cannulation (cont'd)
 - Align catheter in the direction of the vein.
 - Puncture midway between jaw and midclavicular line.
 - Stabilize vein.
 - Proceed cannulation as if for a peripheral vein.
 - Tape line securely.

Pediatric IV Therapy Considerations

- Catheters
 - Best gauges for over-the-needle catheters are:
 - 20, 22, 24, 26
 - Butterfly catheters are ideal.



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Pediatric IV Therapy Considerations

- IV locations
 - Explain your actions to child and parent.
 - Hand veins remain the location of choice.
 - Technique for starting pediatric IV line:
 - Use penlight to illuminate veins through back of hand.
 - Scalp vein cannulation can be difficult.

Older Adult IV Therapy Considerations

- Use smaller catheters.
 - Puncturing the vein may cause massive hematomas.
- Tape may damage skin.



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Older Adult IV Therapy Considerations

- Be careful using macrodrips.
- Locations
 - Consider poor vein elasticity
 - Avoid spidery veins and varicose veins.

Factors Affecting IV Flow Rates

- Checks to perform after IV administration:
 - Fluid
 - Administration set
 - Height of bag
 - Catheter type
 - Constricting band
 - No clamping of line
 - Positioning of line

Local IV Site Reactions and Complications

- Infiltration: Escape of fluid into surrounding tissue
 - Causes area of edema
 - Causes include:
 - Catheter passes through vein and out other side.
 - Patient moves excessively.
 - Tape becomes loose or dislodged.
 - Catheter is inserted at too shallow an angle.

Local IV Site Reactions and Complications

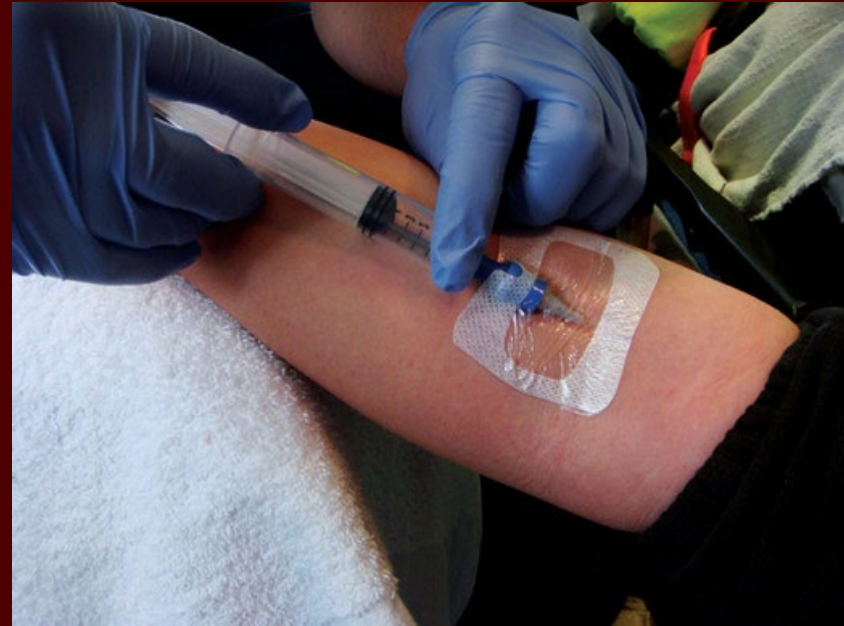
- Infiltration (cont'd)
 - If infiltration occurs:
 - Discontinue the IV line.
 - Reestablish IV line in the opposite extremity.
 - Apply direct pressure over the area.
 - Do not wrap tape around extremity.

Local IV Site Reactions and Complications

- Occlusion: Blockage of vein or catheter
 - First sign: Decreasing drip rate or blood in the IV tubing
 - May develop due to:
 - Position of catheter within the vein
 - Patient's blood pressure overcoming the flow

Local IV Site Reactions and Complications

- Occlusion (cont'd)
 - To determine whether an IV line should be reestablished:
 - Add pressure and disrupt the occlusion.
 - If occlusion does not dislodge:
 - Discontinue.
 - Reestablish IV in opposite extremity.



Courtesy of Rhonda Hunt.

Local IV Site Reactions and Complications

- Vein irritation
 - Often caused by too-rapid infusion rate
 - If redness at the IV site occurs:
 - Discontinue the IV line.
 - Save the equipment for analysis.
 - Reestablish the IV line in the other extremity with new equipment.

Local IV Site Reactions and Complications

- Thrombophlebitis: Inflammation of the vein
 - May be caused by lapses in aseptic technique
 - Pain and tenderness along the vein and redness and edema at the venipuncture site
 - Appears several hours after IV therapy
 - Stop the infusion and discontinue the IV at that site.

Local IV Site Reactions and Complications

- Thrombophlebitis (cont'd)
 - Can be prevented by:
 - Disinfecting the skin over the site
 - Wearing gloves during venipuncture
 - Not contaminating site after it has been prepped
 - Covering site with sterile dressing
 - Anchoring catheter and tubing

Local IV Site Reactions and Complications

- Hematoma
 - Often caused by:
 - Vein perforation
 - Improper catheter removal



Courtesy of Rhonda Hunt.

Local IV Site Reactions and Complications

- Hematoma (cont'd)
 - Develops while inserting catheter: Stop and apply direct pressure.
 - Develops after inserting catheter: Evaluate the IV flow.
 - Apply pressure if it develops as a result of discontinuing the IV.

Local IV Site Reactions and Complications

- Nerve, tendon, or ligament damage
 - Results in sudden and severe shooting pain
 - Remove catheter and select another IV site.
- Arterial puncture
 - Bright red blood will spurt through the catheter.
 - Withdraw the catheter and apply direct pressure for at least 5 minutes.

Systemic Complications

- Pyrogenic reactions
 - Pyrogens: Foreign proteins that produce fever
 - Begins within 30 minutes after infusion has been started
 - Stop the infusion immediately.
 - Avoid by inspecting IV bag before use.

Systemic Complications

- Circulatory overload
 - Problems may occur in patients with cardiac, pulmonary, or renal dysfunction.
 - To treat:
 - Slow the IV rate.
 - Raise the patient's head.
 - Administer high-flow oxygen.
 - Monitor vital signs and breathing adequacy.

Systemic Complications

- Vasovagal reactions
 - Anxiety may cause vasculature dilation.
 - To treat:
 - Place patient in shock position.
 - Apply high-flow oxygen.
 - Monitor vital signs.
 - Establish an IV line.

Systemic Complications

- Catheter shear
 - Needle slices through catheter, creating a free-flowing segment.
 - Treatment involves surgical removal of the tip.
 - If you suspect a catheter shear:
 - Put patient in left lateral recumbent position.
 - Do not rethread a catheter.

Intraosseous Infusion

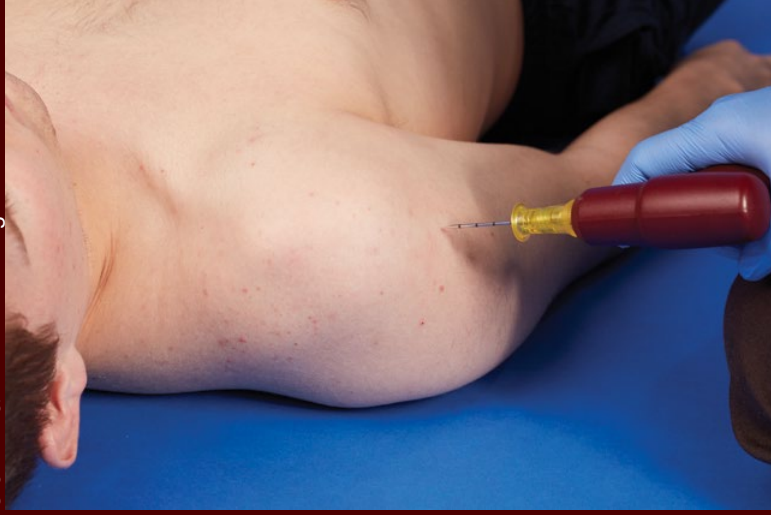
- IO space comprises spongy cancellous bone of the epiphyses and medullary cavity of the diaphysis.
- IO space remains patent even if IV access is difficult.
 - Quickly absorbs IV fluids and medications

IO Sites

- Three common sites for IO insertion:
 - Sternum
 - Humerus
 - Proximal tibia

IO Sites

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Courtesy of Stephen J. Rahm, NRP.



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IO Sites

- Humeral IO site
 - Manipulate arm and palpate humeral head.
- Proximal tibia IO site
 - Flat bone is medial to tibial tuberosity, the bony protuberance just below the knee.
- Distal tibia IO site
 - Palpate to identify medial malleolus.
 - Adults: 2 to 3 cm above that site
 - Pediatric: 1 to 2 cm above

Equipment for IO Infusion

- Manually inserted IO needles
 - Solid boring needle inserted through hollow needle
 - Pushed into bone via screwing and twisting



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Equipment for IO Infusion

- FAST
 - Not for children
 - Design elements allow for IO placement in sternum.
 - Can be used during cardiac arrest



© Pyng Medical Corporation.

Equipment for IO Infusion

- EZ-IO
 - Battery-powered driver with an attached IO needle
 - Inserts IO needle into proximal tibia



Courtesy of VidaCare Corporation.

Table 14-4

EZ-IO Needle Sizes and Determination Criteria

EZ-IO Needle ^a	EZ-IO Needle Size (mm)	Needle Determination Criteria ^b
	15	3–39 kg
	25	> 40 kg
	45	Excessive subcutaneous tissue and humeral IO insertion

^aAll needles are 15 gauge.

^bDetermination criteria may vary based on the amount of subcutaneous tissue present.

Abbreviation: IO, intraosseous

Data from: Arrow EZ-IO Intraosseous Vascular Access. EZ-IO Intraosseous Vascular Access Needles; Instructions for Use. 8082 Rev A. July 2014. http://www.teleflex.com/en/usa/ezioeducation/documents/8082_Rev_A_US_FDA_Intraosseous_Infusion_System_IFU.PDF. Accessed February 15, 2017.

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Equipment for IO Infusion

- Bone Injection Gun (BIG)
 - Spring-loaded device
 - Inserts IO needle into proximal tibia



Courtesy of PerSys Medical.

Equipment for IO Infusion

- New Intraosseous (NIO) device
 - Spring-loaded device that contains neither drill nor battery
 - Placed in proximal tibia of adult



Courtesy of PerSys Medical.

Performing IO Infusion

- To attach the FAST1 device:
 - Align the adhesive target.
 - Prepare insertion site on patient's manubrium.
 - Align stabilization needles.
 - Apply pressure until infusion tube separates from introducer.
 - Discard the stabilization needle.
 - Attach IV tubing to insertion tube's Luer-lock.

Potential Complications of IO Infusion

- Extravasation
- Osteomyelitis
- Failure to identify the proper anatomic landmark can damage the growth plate.

Potential Complications of IO Infusion

- Improper technique can cause fracture.
- Through-and-through insertion occurs when IO needle passes through both sides of the bone.
- A pulmonary embolism (PE) can occur if particles find their way into the systemic circulation.

Contraindications to IO Infusion

- Functional IV line is available.
- Fracture of the bone intended for IO cannulation
- Osteoporosis
- Osteogenesis imperfecta
- Bilateral knee replacements
- Prosthetic limb

Medication Administration

- Understand how medications affect the human body before administering them.
 - Become familiar with:
 - Mechanism of action
 - Indications
 - Contraindications
 - Side effects
 - Routes of administration
 - Pediatric and adult doses
 - Antidotes

Mathematical Principles Used in Pharmacology

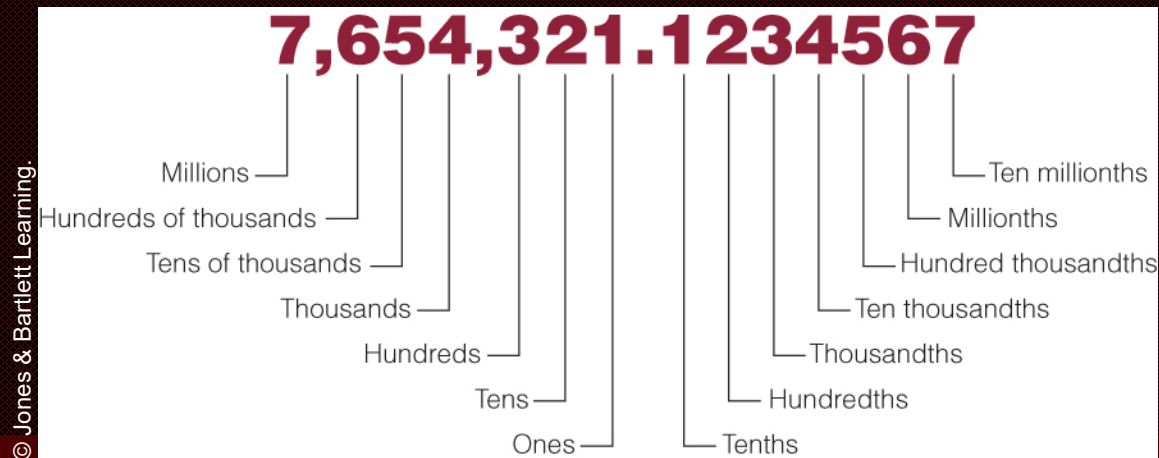
- Mathematics review
 - Fractions represent a portion of a whole number.
 - Decimals distinguish numbers that are greater than zero from numbers that are smaller than zero.

Mathematical Principles Used in Pharmacology

- Mathematics review (cont'd)
 - Dividing or multiplying by 10:
 - When dividing, move decimal point to the left.
 - When multiplying, move decimal point to the right.
 - Percentages are part of 100 and use the % symbol.

Mathematical Principles Used in Pharmacology

- The metric system
 - Based on multiples of ten
 - Measures length, volume, weight
 - Meter (m): Length
 - Liter (L): Volume
 - Gram (g): Weight



Mathematical Principles Used in Pharmacology

- The metric system (cont'd)
 - Prefixes demonstrate the fraction of the base being used.

Table 14-5 Units of Measurement				
Volume		Numeric Value	Concentration	
Abbreviation	Unit		Abbreviation	Unit
kL	Kiloliter	1,000	kg	Kilogram
L	Liter	1	g	Gram
mL	Milliliter	0.001	mg	Milligram
mCL	Microliter	0.000001	mCG	Microgram

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Table 14-6 Symbols Used in the Metric System	
Unit	Symbol
Weight (smallest to largest)	
Microgram	mCG
Milligram	mg
Gram	g (or gm)
Kilogram	kg
Volume (smallest to largest)	
Milliliter	mL
Deciliter	dL
Liter	L

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Mathematical Principles Used in Pharmacology

- Drugs are supplied and packaged in a variety of weights and volumes.
 - You will be required to convert weights to volumes and vice versa

Table 14-7	Metric Units
Unit	Equivalent
Weight (smallest to largest)	
1 mcg	0.001 mg
1 mg	1,000 mcg
1 g	1,000 mg
1 kg	1,000 g
Volume (smallest to largest)	
1 mL	1 cc*
100 mL	1 dL
1,000 mL	1 L
*Cubic centimeters (cc) is a unit also used to represent milliliters (mL); therefore, 1 cc is the same as 1 mL (1 cc = 1 mL).	
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Mathematical Principles Used in Pharmacology

- Volume conversion
 - Prehospital setting uses two measurements of volume: Milliliters and liters.
 - mL to L: Divide smaller volume by 1,000
 - L to mL: Multiply L by 1,000

Mathematical Principles Used in Pharmacology

- Weight conversion
 - Large unit to small: Multiply large by 1,000
 - Small unit to large: Divide large by 1,000

Mathematical Principles Used in Pharmacology

- Converting pounds to kilograms
 - Two formulas:
 - Divide the patient's weight in pounds by 2.2.
 - Divide the patient's weight in pounds by 2 and subtract 10% of that number.

Mathematical Principles Used in Pharmacology

- Temperature conversion
 - To convert Fahrenheit to Celsius:
 - Subtract 32 then multiply by 0.555 ($5/9$).
 - To convert Celsius to Fahrenheit:
 - Multiply by 1.8 ($9/5$) then add 32.

Calculating Medication Doses

- Desired dose: Amount of drug ordered by the physician
 - Expressed as standard dose or specific number of micrograms, milligrams, or grams

Calculating Medication Doses

- Drug concentrations: Total weight of the drug contained in a specific amount of volume
 - Volume on hand: Volume of solution that the drug is contained in
 - Weight of drug present in 1 mL = concentration

Calculating Medication Doses

- Volume to be administered
 - $\text{Desired dose (mg)} / \text{Concentration of drug on hand (mg/mL)} = \text{Volume to be administered}$

Weight-Based Drugs

- Medication doses are based on patient's weight in kilograms.
- Add one step to the formula: Convert the patient's weight in pounds to kilograms

Calculating Fluid Infusion Rates

- Adjust flow rate based on patient's condition
 - To calculate the flow rate:

$$\frac{\text{Volume to be infused} \times \frac{\text{gtt}}{\text{mL}} \text{ of administration set}}{\text{total time of infusion in minutes}} = \text{gtt/min}$$

Calculating the Dose and Rate for a Medication Infusion

- Non-weight-based medication infusion
 - Use the same formula to calculate a drug dose.
 - Then calculate the desired dose to be administered continuously:

$$\frac{\text{mL per minute} \times \text{drops per milliliter}}{\text{total times in minutes}} = \text{continuous infusion rate}$$

Calculating the Dose and Rate for a Medication Infusion

- Weight-based medication infusions
 - Use the previously discussed formula.
 - Factor in the patient's weight in kilograms

Pediatric Drug Doses

- Methods to determine the right dose:
 - Length-based resuscitation tape measures
 - Pediatric wheel charts
 - EMS field guide with tables or charts
- Most drugs are based on child's weight in kg.



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Enteral Medication Administration

- Enteral medications are those given through the digestive or intestinal tracts.
- Forms include:
 - Capsules, time-released capsules, lozenges, pills, tablets, elixirs, emulsions, suspensions, syrups

Oral Medication Administration

- Drugs are absorbed at a slow rate (30 to 90 minutes).
- Check for:
 - Indications
 - Contraindications
 - Precautions
- Review the 10 rights prior to administration.

Oral Medication Administration

- When administering an oral medication:
 - Determine need for medication.
 - Obtain history.
 - Follow standing orders/contact medical control.
 - Check the medication and determine dose.



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Oral Medication Administration

- When administering an oral medication (cont'd):
 - Instruct patient to swallow with water.
 - Monitor patient, and document findings.

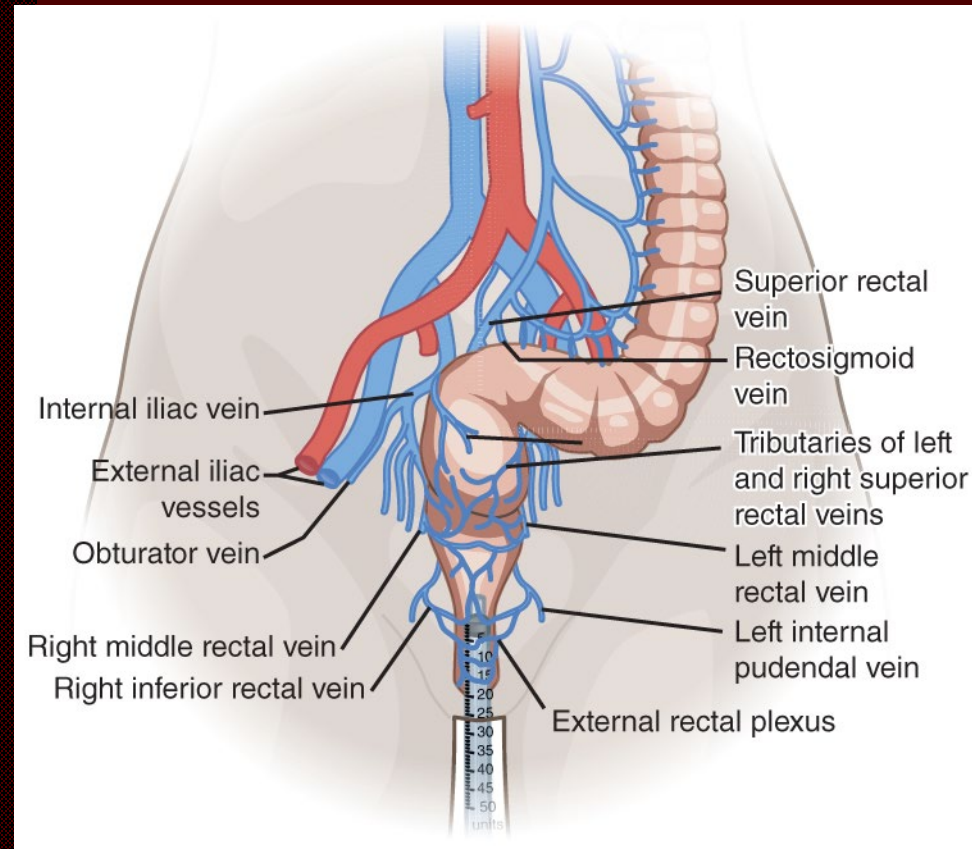


Orogastric and Nasogastric Tube Medication Administration

- Gastric tubes are occasionally inserted to:
 - Decompress stomach
 - Perform gastric lavage
 - Establish a route for administration
- Most common solution administered is tube feeding.

Rectal Medication Administration

- Medication absorption is rapid and predictable.
- Some medications are available in suppository form.



Rectal Medication Administration

- To administer drugs rectally:
 - Determine the need for the medication.
 - Obtain a history.
 - Follow standing orders/contact medical control.
 - Determine dose, and ensure it is correct.
 - Lubricate and insert into the rectum 1 to 1.5 inches.

Rectal Medication Administration

- To administer drugs rectally (cont'd):
 - Modifications may be needed for liquid form
 - Lubricate device and insert 1 to 1.5 inches into rectum.
 - Tell patient not to bear down.
 - Push medication through tube with needleless syringe.
 - Remove and dispose of tube.
 - Monitor patient, and document findings.

Parenteral Medication Administration

- Any route other than the gastrointestinal tract
- Medications are absorbed into the central circulation faster and at a predictable rate.

Parenteral Medication Administration

- Syringes and needles
 - Syringes consist of:
 - Plunger
 - Body or barrel
 - Flange
 - Tip
 - Most syringes are marked with 10 calibrations per milliliter on one side.

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Parenteral Medication Administration

- Hypodermic needles vary from 3/8" to 2" for standard injections.
 - Gauge refers to diameter
 - Smaller number = larger diameter
 - Proximal end of needle (hub) attaches to standard fitting on syringe
 - Distal end is beveled.

Packaging of Parenteral Medications

- Ampules
 - Breakable sterile glass containers
 - Carry one dose of medication



Packaging of Parenteral Medications

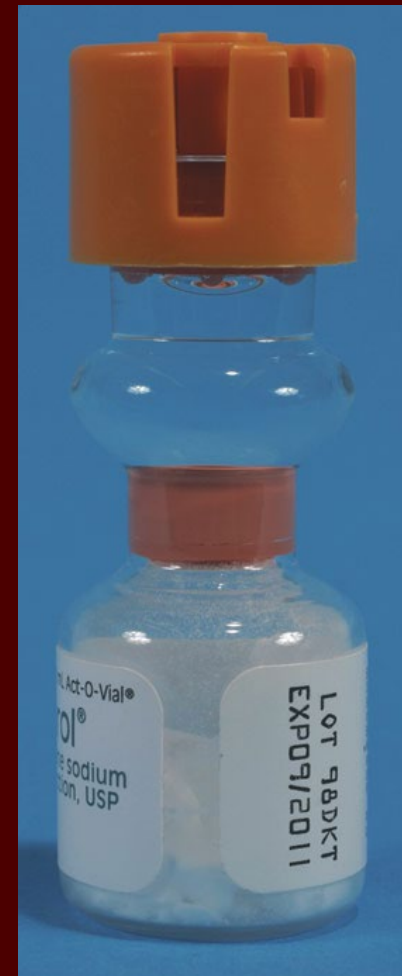
- Vials
 - Glass or plastic bottles with rubber stopper top
 - Contain single or multiple doses
 - Removing the cover makes it no longer sterile.



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Packaging of Parenteral Medications

- Vials (cont'd)
 - Medications may need to be reconstituted.
 - Mix-o-Vial: Two compartments
 - Squeeze vials together and then shake.



Packaging of Parenteral Medications

- Prefilled syringes
 - Packaged in tamper-proof boxes
 - Two types:
 - Separated into a glass cartridge and syringe
 - Preassembled prefilled syringes



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Packaging of Parenteral Medications

- Single-dose medication cartridges inserted into a reusable syringe are available.



Packaging of Parenteral Medications

- Push-dose pressors
 - Some vasopressors are available in a small bolus format.
 - Using push-dose epinephrine involves mixing the appropriate concentration.

Intradermal Medication Administration

- Involves administering a small amount of medication into the dermal layer
- Avoid superficial blood vessels.
- Medications have a slow absorption rate.

Intradermal Medication Administration

- To administer medication intradermally:
 - Determine need for medication.
 - Obtain history.
 - Follow standing orders/contact medical control.
 - Check the medication.
 - Explain procedure to patient.
 - Assemble and check equipment needed.

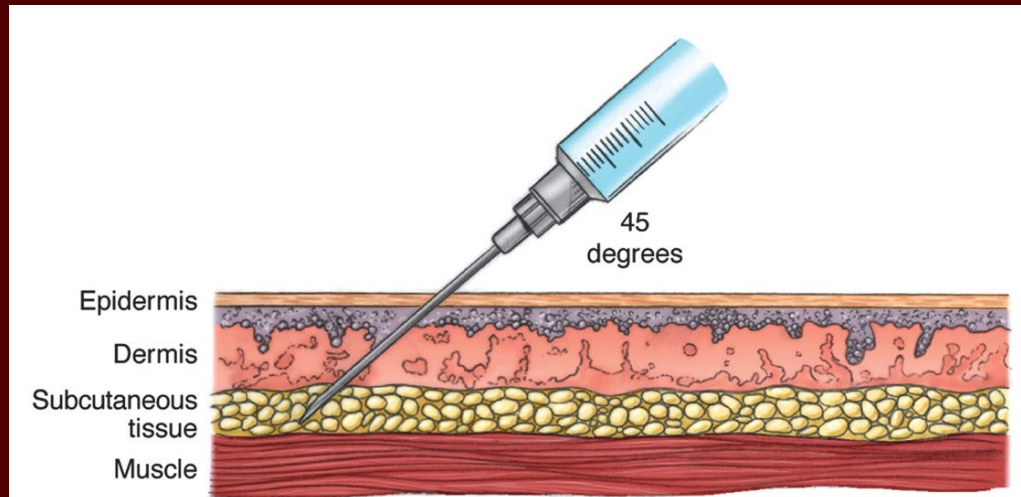
Intradermal Medication Administration

- To administer medication intradermally (cont'd):
 - Cleanse the area for injection.
 - Pull skin taut.
 - Insert the needle and slowly inject medication.
 - Remove the needle and dispose of it.
 - Monitor the patient and document findings.

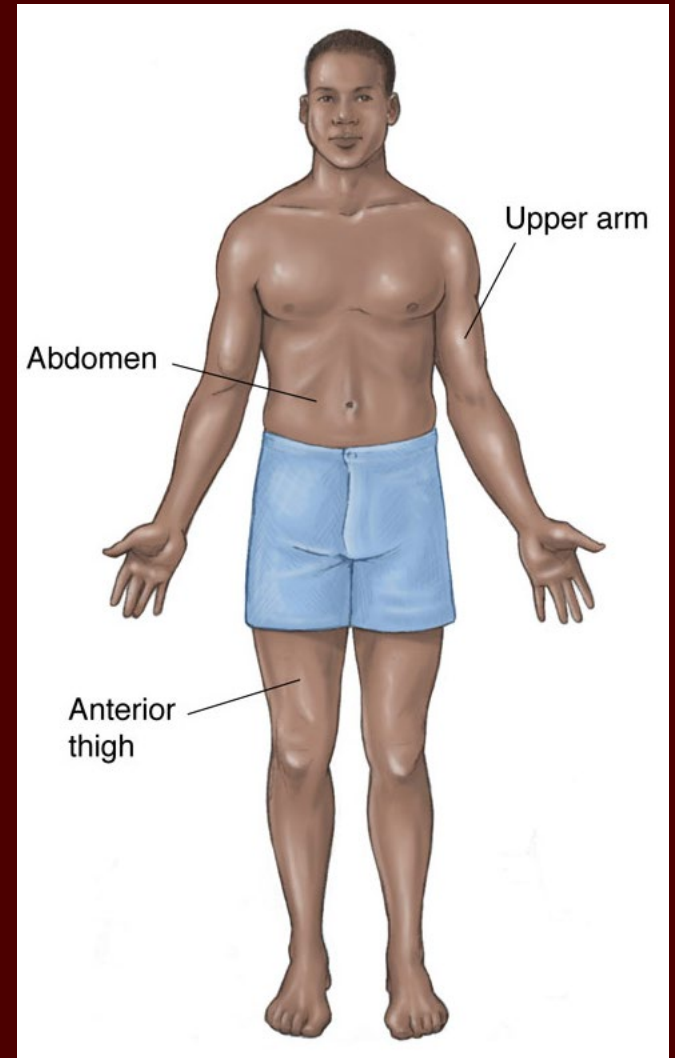
Subcutaneous Medication Administration

- Given into connective tissue between dermis and muscle
- Common sites include:
 - Upper arms
 - Anterior thighs
 - Abdomen

Subcutaneous Medication Administration



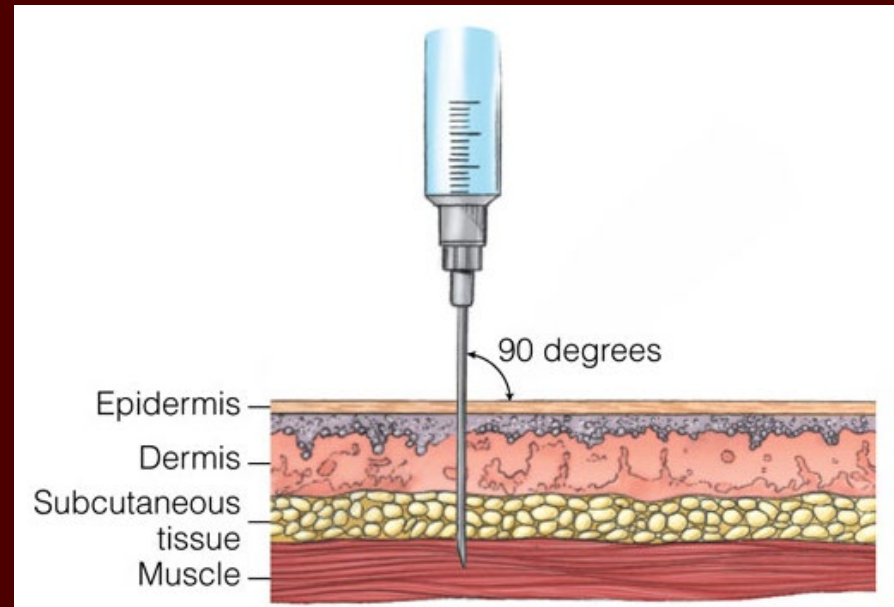
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Intramuscular Medication Administration

- Needle penetrates through the dermis and subcutaneous tissue and into the muscle layer
 - Allows larger volume of medication
 - Potential to damage nerves

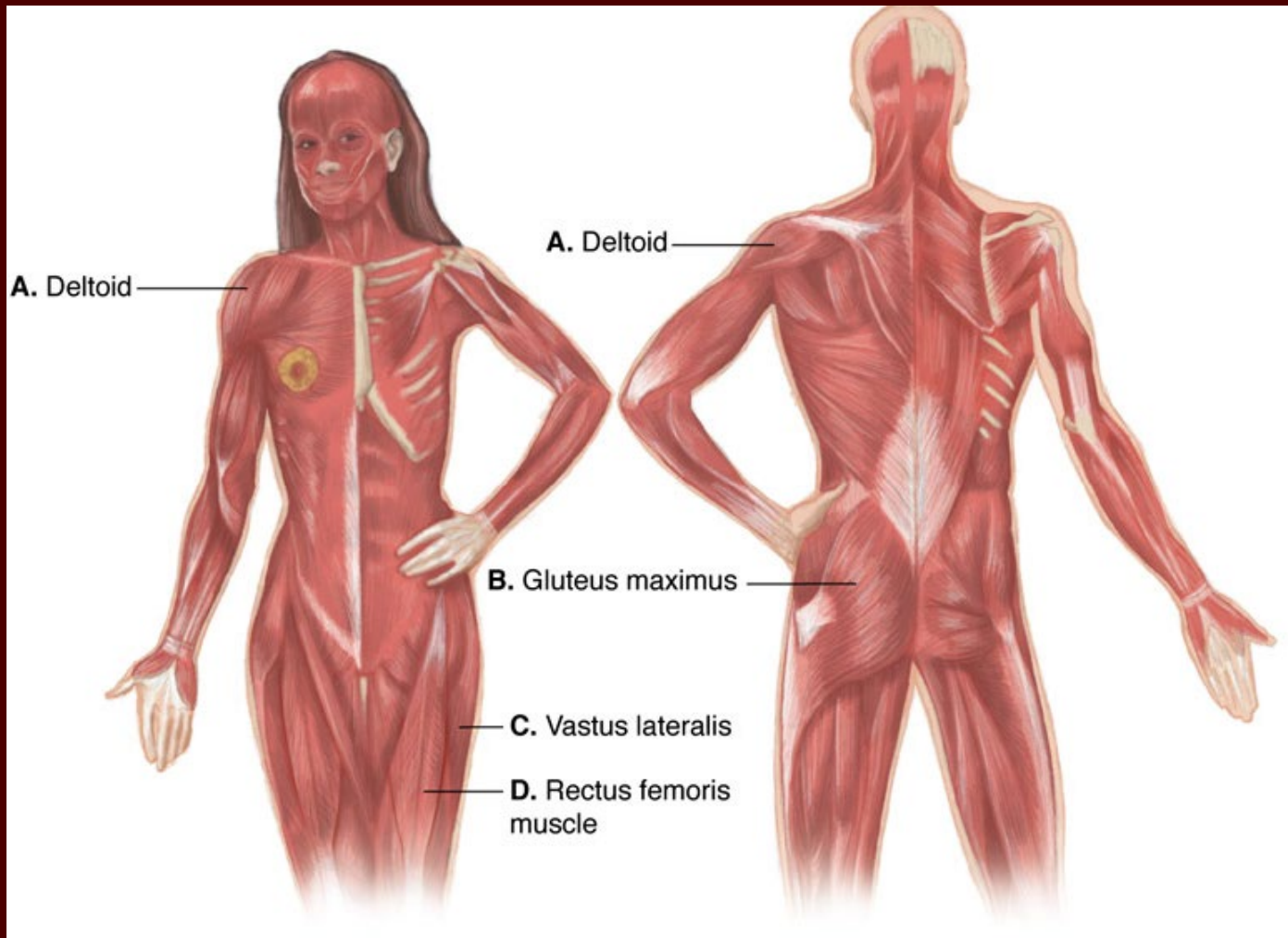


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Intramuscular Medication Administration

- Common sites include:
 - Vastus lateralis muscle
 - Rectus femoris muscle
 - Gluteal area
 - Deltoid muscle

Intramuscular Medication Administration



IV Bolus Medication Administration

- Drugs go directly into the circulatory system.
 - Direct injection of drugs with a needle and syringe into IV line
 - Needleless systems now available.
 - A bolus is a single dose given by the IV route.
 - Small or large quantity of a drug
 - Delivered rapidly or slowly

IV Bolus Medication Administration

- To administer medication through a saline lock:
 - Determine the need for the medication.
 - Obtain a history.
 - Follow standing orders/contact medical control.
 - Check the medication.
 - Explain the procedure to the patient.

IV Bolus Medication Administration

- To administer medication through a saline lock (cont'd):
 - Assemble equipment and draw up medication.
 - Cleanse the injection port or remove the cap.
 - Insert the needle into the port or screw the syringe onto the port.
 - Pull back on the plunger and observe for blood.
 - Place needle and syringe into a sharps container.

IV Bolus Medication Administration

- To administer medication through a saline lock (cont'd):
 - Clean the port; insert the needle with the flush.
 - Flush and place needle in sharps container.
 - Store any unused medication properly.
 - Monitor the patient and document findings.

IV Bolus Medication Administration

- Adding medication to IV bag
 - Check fluid in the IV bag.
 - Check name and concentration.
 - Compute volume to be added, and draw up in syringe.
 - Cleanse the injection port.
 - Inject medication.
 - Withdraw and dispose of needle



IV Bolus Medication Administration

- Adding medication to IV bag (cont'd)
 - Agitate bag.
 - Label the IV bag with the:
 - Name of the medication added
 - Amount added
 - Concentration in the IV bag
 - Date and time
 - Your name
 - Attach IV administration set and prepare bag.

IV Bolus Medication Administration

- IV piggyback
 - Administration set directly connected to hub of IV catheter is primary line.
 - When performing continuous infusion, take distal end of drip set and connect it to primary line.

IV Bolus Medication Administration

- IV infusion pumps
 - Benefits include:
 - Deliver the rates set by the pump without deviating
 - Calculate amount of fluid infused and remaining
 - Problems include:
 - Lack of uniformity among manufacturers
 - Air trapping causes pump to stop and alarm

IV Bolus Medication Administration

- IV infusion pumps (cont'd)
 - Deliver fluids via positive pressure.
 - May be designed to accommodate:
 - IV tubing to regulate the flow of fluids
 - Needleless syringe



Courtesy and © Becton, Dickinson and Company.



Courtesy of Baxter International Inc.

IV Bolus Medication Administration

- IV infusion pumps (cont'd)
 - May have multiple chambers for multiple medications
 - May have databases that calculate rate by desired dose and patient's weight
 - IV infusion pumps come in a wide variety.

IO Medication Administration

- Fluid does not flow well into the bone.
 - Use a large syringe.
 - A pressure infuser device forces fluid from the IV bag.
- Potential for compartment syndrome

Percutaneous Medication Administration

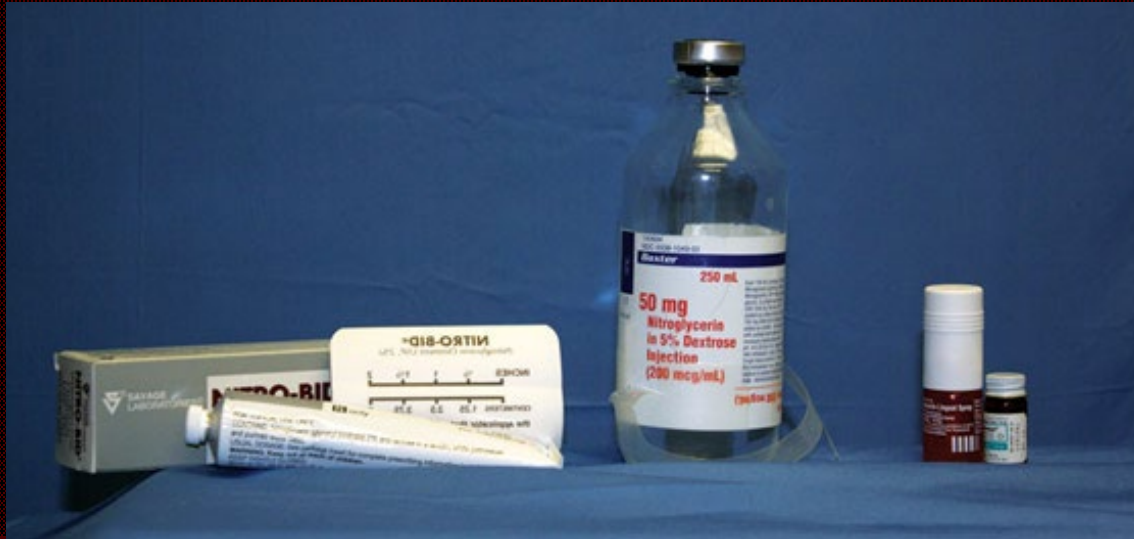
- Medications are applied to and absorbed through the skin and mucous membranes.
- Transdermal medication administration
 - Applied topically
 - Useful for sustained release of medication

Percutaneous Medication Administration

- Transdermal medication administration (cont'd)
 - To apply:
 - Determine need for medication; obtain history.
 - Follow standing orders/contact medical control.
 - Check the medication.
 - Explain the procedure to patient.
 - Clean area and apply the medication.
 - Monitor patient and document findings.

Percutaneous Medication Administration

- Sublingual medication administration
 - Area is highly vascular.
 - Medication is rapidly absorbed.
 - Drugs may also be injected under the tongue.



Percutaneous Medication Administration

- Buccal medication administration
 - Region lies in between the cheek and gums.
 - Medication comes in the form of tablets or gel.

Percutaneous Medication Administration

- Buccal medication administration (cont'd)
 - To administer medication:
 - Determine the need and obtain history.
 - Follow standing orders/contact medical control.
 - Check medication and explain procedure to patient.
 - Place medication between cheek and gum.
 - Advise patient to allow the tablet to dissolve slowly.
 - Monitor patient and document findings.

Percutaneous Medication Administration

- Ocular medication administration
 - Drops or ointment
 - Typically administered for pain relief, allergies, and infections
 - Medication rarely administered via ocular route in prehospital setting



© Adam Bronkhorst/Alamy.

Percutaneous Medication Administration

- Ocular medication administration (cont'd)
 - To assist a patient:
 - Confirm prescription.
 - Have patient tilt head and look up.
 - Expose conjunctiva and administer medication.
 - Advise patient to close eye for 1 to 2 minutes.
 - Document medication name, dose, and time.

Percutaneous Medication Administration

- Aural medication administration
 - Administered via ear canal
 - To assist a patient:
 - Confirm prescription.
 - Place patient on side with affected ear facing up.
 - Expose the ear canal.
 - Administer medication with a medicine dropper.
 - Document medication name, dose, and time.

Percutaneous Medication Administration

- Intranasal medication administration
 - Includes nasal spray or solutions
 - Rapidly absorbed
 - Performed with a mucosal atomizer device (MAD)
 - Requires 2 to 2.5 times the dose of IV medications



Courtesy of Wolfe Tory Medical, Inc.

Medications Administered by the Inhalation Route

- Nebulizer and metered-dose inhaler
 - Patient with a history of respiratory problems will likely have a metered-dose inhaler (MDI).



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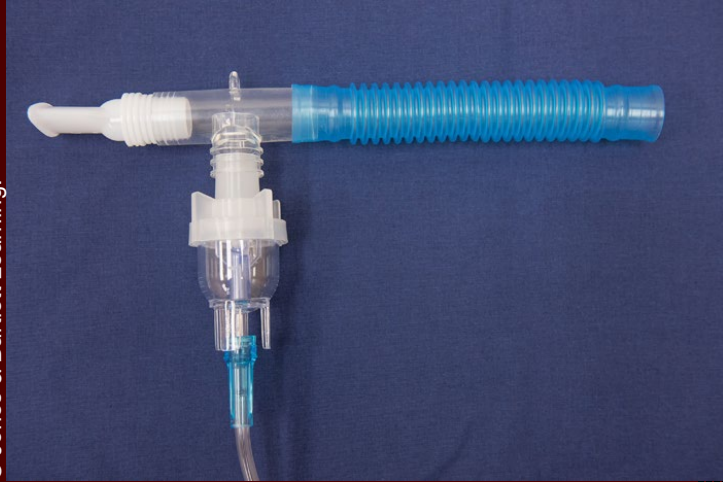


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Medications Administered by the Inhalation Route



- Nebulizer and metered-dose inhaler (cont'd)
 - Liquid bronchodilators may be aerosolized for inhalation.
 - Blow-by administration or a nebulized mask



Medications Administered by the Inhalation Route

- Nebulizer and metered-dose inhaler (cont'd)
 - If patients are breathing inadequately:
 - Assist with bag-mask ventilation.
 - Attach a small-volume nebulizer to device.
 - Place a short piece of corrugated tubing between the bag and mask or endotracheal tube.
 - Most CPAP manufacturers have a nebulizer designed for their device.

Medications Administered by the Inhalation Route

- Endotracheal medication administration
 - Only four medications are accepted for administration (remember mnemonic LEAN):
 - Lidocaine
 - Epinephrine
 - Atropine
 - Naloxone (Narcan)
 - Check your local protocols prior to administration.

Long-term Vascular Access Devices

- Long-term vascular access devices
 - Patients may request a peripheral line is not used.
 - Two types: Non-tunneling and implanted
 - Most protocols only allow access during critical events.
 - Preserved with heparin

Long-term Vascular Access Devices

- Long-term vascular access devices (cont'd)
 - Non-tunneling devices have been inserted by direct venipuncture and include:
 - Peripheral inserted central catheters (PICC)
 - Midlines inserted at the antecubital vein

Long-term Vascular Access Devices

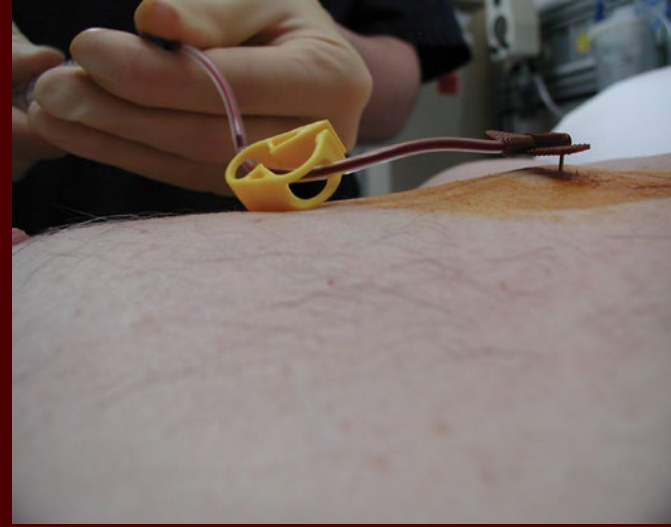
- Long-term vascular access devices (cont'd)
 - Implanted vascular access devices are implanted in surgery.
 - Access with a Huber needle
- Arterioventricular (AV) fistulas
 - Used for hemodialysis and plasmapheresis

Long-term Vascular Access Devices

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Rates of Medication Absorption

- Drugs are absorbed at a speed directly related to the route of delivery.
 - Drugs injected into the bloodstream are fastest.
 - Oral medications take longer.

Rates of Medication Absorption

Table 14-9

Medication Routes and Rates of Absorption

Route of Administration	Onset of Action ^a
Intraosseous	30–60 s
Intravenous	30–60 s
Endotracheal	2–3 min
Inhalation	2–3 min
Nasal mucosal atomization	3–5 min
Sublingual	3–5 min
Intramuscular injection	10–20 min
Subcutaneous injection	15–30 min
Rectal	5–30 min
Oral	30–90 min
Topical	Minutes to hours

^aIn a healthy person with adequate perfusion

Data from: Verma P, Thakur AS, Deshmukh K, Jha AK, Verma S. Routes of drug administration. *Int J Pharm Sci Res*. 2010 Jul-Sep;1(1):54-59. <http://www.technicaljournalonline.com/ijpsr/VOL%201/IJPSR%20VOL%201%20ISSUE%201%20JULY%20SEPTEMBER%202010/IJPSR%20VOL%201%20ISSUE%201%20Article%208.pdf>. Accessed February 16, 2017.

Rates of Medication Absorption

Table 14-10

Examples of Specific Medications

Drug	Route	Onset	Peak	Duration
Metoprolol tartrate (Lopressor)	PO	15 min	1 h	6–12 h
	IV	Immediate	20 min	5–8 h
Fentanyl citrate (Sublimaze)	Transdermal	6–8 h	12–24 h	72 h
	IV	Immediate	3–5 min	20–40 min
	IM	7–8 min	20–30 min	1–2 hours
	Intranasal	1–2 min	9–15 min	20–40 min
Naloxone	IV	0–2 min	0–2 min	20–120 min
	IM	2–10 min	2–10 min	20–120 min
	ET	2–10 min	2–10 min	20–120 min
	Intranasal	2–10 min	2–10 min	20–120 min

Abbreviations: ET, endotracheal; IM, intramuscular; IV, intravenous; PO, per os (oral route/by mouth)

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Thank You



Please continue to the next section