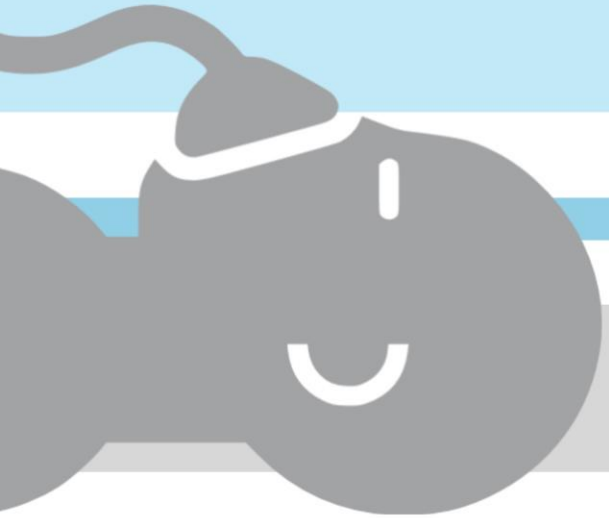

ANESTHESIA

(6) Venous Access and Medication Administration

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Revised by: Mody A. Almarshad

Doctor's note Team's note Not important Important 431 teamwork

(431 teamwork do not highlight it in yellow, but put it in a yellow "box")

Objectives:

1. Examine the construction of the commonly used venous catheters.
2. Anatomical considerations regarding peripheral and central venous access.
3. Discuss the choice of catheter size.
4. Prepare and set-up an IV infusion set.
5. Discuss the choice of sites for placement of IV catheters.
6. What are the different sites suitable for central venous catheter placement?
7. Discuss universal precautions.
8. Indications and complications of central venous access

Safety Considerations

- Five patient "rights" of drug administration
  - Drug
  - Dose
  - Patient
  - Route
  - Time
  - Correct and thorough documentation (sixth patient right of drug administration)
- **Read drug label and compare it to the order three times before administration**:
  - When removing the drug from the drug kit
  - When preparing the drug for administration
  - Just before giving it to the patient (before the container is discarded)
- Verify route of administration
- Be sure medication label matches the order.
- Never give a drug from an unlabeled container.
- If unsure of your drug calculation, have a coworker or medical direction recheck.
- Handle multi-dose vials with aseptic technique so that medicines are not wasted or contaminated.
- When preparing multiple injections, always label the syringe immediately.
  - Keep the medication container with the syringe.
  - Do not rely on memory.
- *Never* administer unlabeled medication prepared by another person.
- *Never* give medication that is:
  - Outdated
  - Discolored
  - Cloudy
  - Tampered with
- If anyone expresses concern about a medication or dose. Recheck to be certain that there is no error. Main concern in pediatrics
- Patient has right to refuse medication.
- Monitor patient for any adverse effects for at least 5 min after administration. Longer observation time may be need for intramuscular and oral medications → you may be allergic to one route but not the other
- Document medications given:
  - Name of drug, dosage, time, and route.
  - Note injection site of parenteral drugs.
  - Record patient's response.
  - Adverse as well as intended.

- For return and disposal of unused medication, follow:
  - Governmental guidelines
  - Local EMS (Emergency Medicine System) policies.
  - E.g narcotics and suggamadex are agents that should be returned to the pharmacy once finished from

Medication Errors

- **Common causes:**
  - Wrong dose ordered by the prescriber → should be checked by pharmacy and nurses
  - Drug calculations in error
  - Drugs administered by wrong route → due to human error and negligence
  - Wrong patient received drug
- **If a medication error occurs:**
  - Accept responsibility for your actions
  - Immediately advise medical direction
  - Monitor patient for effects of drug
  - Document the medication error as required: for legal purposes
    - State guidelines
    - Medical direction
    - Employer
  - Modify practice to avoid a similar error
  - Follow EMS agency policy for documentation and quality improvement

Medication Asepsis

Removal or destruction of disease-causing organisms or infected material.

- Sterile technique (surgical asepsis)
- Clean technique

Antiseptics and Disinfectants:

- Chemical agents used to kill specific microorganisms.

Disinfectants

- Used on nonliving objects
- Toxic to living tissue → alcohol is bactericidal and highly concentered → can damage the tissue

Antiseptics

- Applied to living tissue
- More dilute to prevent cell damage

Some chemical agents have antiseptic and disinfectant properties.

Universal Precautions:

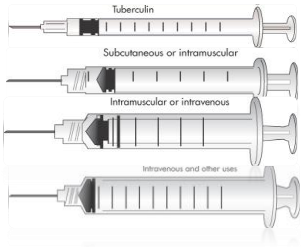
- Universal Standard precautions on *every* patient
- When administering drugs, observe hand washing and gloving procedures if indicated→ you add the sterile gown when you are preparing drugs in the pharmacy or applying a central venous catheter, otherwise washing the hand and wearing gloves is enough
- Face shields indicated during administration of endotracheal drugs→ and when you worry of splash

Syringes and Needles

- **Choice of syringe and needle depends :**

1. Route of administration
2. Characteristics of the fluid(e.g., aqueous, oil based)→ in MRI the dye is an oil solution that requires a bigger gauge
3. Volume of medication

- **Syringes:**
  - Range from 1 mL tuberculin and insulin syringes to 60 mL irrigation syringes.
  - Tuberculin syringes →0.01 mL gradients
  - Insulin syringes→ has 100 units (1 unit increments =0.01ml)



- **Needles:**
  - Vary in length and gauge: Larger gauge means a smaller needle irrespective of the length as they all can have the same length but differ in the diameter
  - They needles are color coded as follows :
  - Yellow is 24 gauge
  - Blue is 22 gauge
  - Pink is 20 gauge
  - Green is 18 gauge

- **Parenteral Medication Containers:**
  1. **Single-dose ampules**
     - Glass containers
     - Hold one dose of a medication for injection
  2. **Multidose vials**
     - Glass containers with rubber stoppers
     - Hold several medication doses
     - Bupivacaine is given as multi dose also some anti-biotics like cephazolin in children when you need to break the dose into smaller doses
  3. **Prefilled syringes**→ Propofol is premade and you just inject it

Preparing Medication for Injection

- Assemble equipment.
- Compute volume of medication to be administered.
- Using a vial:
  - Clean stopper with alcohol→it is bactericidal that kills within one minute so you have to wait that time then insert the needle
  - Inject air into the vial equal to amount of solution to be withdrawn

- Withdrawing Medication from Vial:
  - Withdraw volume required.
  - Remove syringe from vial.
  - Advance plunger of syringe to expel air from solution.

Intravenous Therapy

- Used for access to body's circulation

- Indications:
  1. Administer fluids
  2. Administer drugs
  3. Obtain laboratory specimens →blood

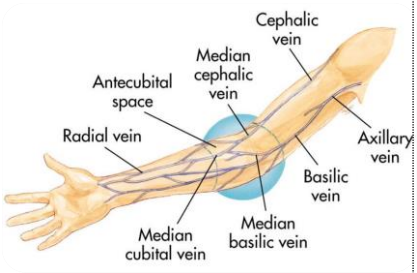
- Route of choice for fluid replacement is peripheral vein in an extremity.

- **Components :**
  1. IV solution
  2. Infusion set
  3. Macrodrip (16-20 drips= 1ml) or microdrip (60 drops =1ml)
  4. Tubing clamp
  5. Injection port

Types of IV Catheters:

1. **Hollow needles**
   - Butterfly type
2. **Indwelling plastic catheter over hollow needle** →IV cannula
3. **Indwelling plastic catheter inserted through a hollow needle**
   - Intracath

➢ **Peripheral IV Insertion:**



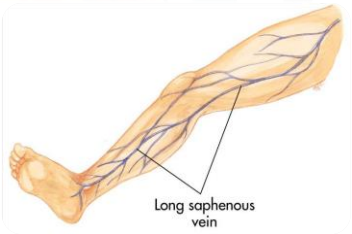
⦿ Common sites:

- Dorsum of Hands and arms → choose a straight vein and avoid ones near the joints due to risk of kink and dislodge
- Antecubital fossa (AC space)

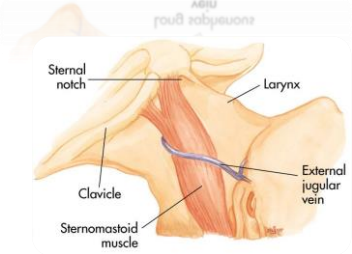
⦿ Alternate sites:

- Long saphenous veins→in cases of venous cut down
- External jugular veins
- In neonates → the scalp can be used

- Embolism and infection rates higher.



⦿ Avoid sites that have injury or disease:



- Trauma
- Dialysis fistula
- History of mastectomy
  → avoid the upper limb of the excised site as the venous drainage is not as good and if it was bilateral mastectomy then go for lower limbs as venous access.
- Infection sites

⦿ **The procedure :**

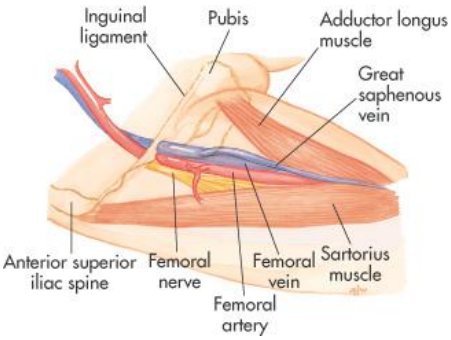
- Explain procedure
- Assemble equipment
- Inspect fluid for contamination, appearance, and expiration date
- Prepare infusion set
  Attach infusion set to bag of solution
- Clamp tubing and squeeze reservoir on infusion set until it fills half way
- Open clamp and flush air from tubing
- Close clamp to avoid infection
- Maintain aseptic technique
- Select catheter:
  - Large-bore catheter used for fluid replacement→14 to 16 gauge
  - Smaller bore catheter used for "keep open" lines (continuous fluid)→18 to 20 gauge
- Prepare other equipment
- Put on gloves → for your safety
- Select site
- Apply tourniquet above ante-cubital space
- Prepare site

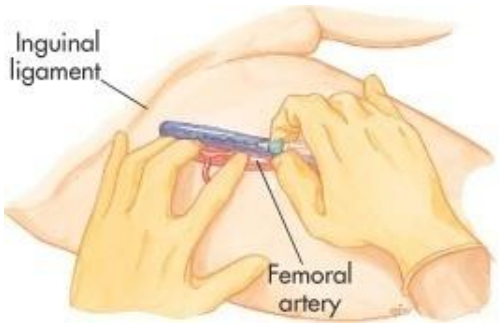
- Cleanse area with alcohol or iodine(bacteriostatic) wipes (per protocol)
- Check for iodine allergy
- Stabilize vein
- Apply pressure and tension to point of entry
- Bevel of the needle up in adults
- May be down in infants and children→ because the vein is superficial and you may injure the tissue
- Pass needle through skin into vein from side or directly on top
- Advance needle and catheter about 2 mm past point where blood return is seen in hub of needle
- Slide catheter over needle and into vein
- Withdraw needle while stabilizing catheter
- Lock in protective sheath if present
- Apply pressure on proximal end of catheter to stop escaping blood
- Obtain blood samples if needed
- Release tourniquet
- Attach IV tubing
- Open tubing clamp and allow fluid infusion to begin at prescribed flow rate
- Cover puncture site dressing
- Antibiotic ointment if indicated by protocol
- Anchor tubing
- Secure catheter
- Document procedure
- Monitor flow

➢ **Notes from the Booklet :**
- No general or regional anesthetic procedure should start without intravenous access
- The major determinant of the flow rate achieved through a cannula is the fourth power of the internal radius. All large-bore intravenous cannula that are inserted before induction of anesthesia should be placed after the intradermal infiltration of lignocaine using a 25 gauge needle.

➢ Central Venous Access:

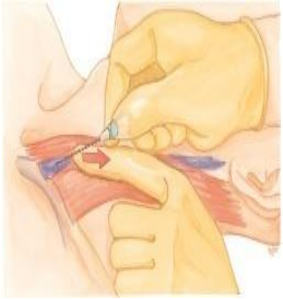
- Within scope of paramedic practice in some EMS systems
- Requires special training
- Authorization from medical direction
- Not for rapid fluid replacement in prehospital setting → the length of the catheter won't allow it to rapidly act
- **Sites include:**
  - Femoral vein
  - Internal jugular vein→ lateral to the carotid artery
  - Subclavian vein→ preferred in head and neck surgeries also in ICU patients because it's away from the mouth drooling patient.
- Prepare as for peripheral veins
- **Success depends on:**
  - Patient's body position
  - Paramedic's knowledge of anatomy
  - Familiarity with the procedure
- Femoral Vein Cannulation → remember (VAN) vein , artery , and nerve (from medial to lateral so for access go medial to the artery pulse and for the nerve block go lateral

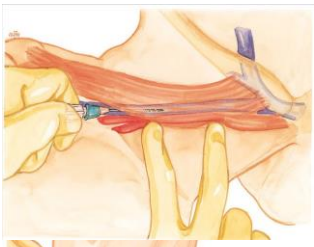




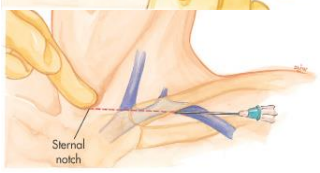
- Internal Jugular Vein Cannulation:
- Posterior approach → at the posterior head if SCM muscle , Also called the higher approach with a risk of injuring the cervical plexus or puncturing the vertebral arteries and causing a hematoma that would compress the nerve.

Central approach→ <u>easiest</u> approach the needle is placed between the two heads of the muscle. , with a chance of hitting the dome of the lung.





- **Anterior approach** → at the anterior edge of the sternocledomatiod , with a chance of hitting the carotid artry



- Subclavian Vein Cannulation → is found between the clavicle and the firt rib.

Advantages

- Available when peripheral vessels collapse
- Access to central pressure measurements → so great for cardiac patients
    - In-hospital procedure
- Safer vasopressor administration

Disadvantages

- Excessive time for placement
- Sterile technique
- Special equipment
- Skill deterioration
- High complication rate
    - Pneumothorax, arterial injury, abnormal placement (catheter goes to the opposite limb)
- Chest x-ray should be obtained immediately
- Can't initiate during other patient care activities
- Not generally considered to be a useful prehospital technique
- Lower flow rates than peripheral IV

Local Complications:

- Pain and irritation
- Infiltration and extravasation → may lead to compartment syndrome and a fasciotomy is needed
- Phlebitis
- Thrombosis and thrombophlebitis
- Hematoma formation
- Venous spasm
- Vessel collapse
- Cellulitis
- Nerve, tendon, ligament, and limb damage

Systemic Complications:

- Contamination and infection
- Hypersensitivity reactions
- Sepsis (inline sepsis)
- Speed shock
- Emboli (blood clot, air, and catheter)

➢ **Infiltration :**

- **Causes:**
  - Dislodgement of catheter or needle cannula during venipuncture
  - Puncture of vein wall during venipuncture
  - Leakage of solution into surrounding tissue from insertion site
  - Poorly secured IV
  - Poor vein or site selection
  - Irritating solution inflames vein's intima
  - Improper cannula size
  - High delivery rate or pressure
- **Signs & Symptoms:**
  - Cool skin around IV site
  - Swelling at IV site
    With or without pain
  - Sluggish or absent flow
  - Infusion flows when pressure is applied to vein above tip of cannula
  - No backflow of blood into IV tubing when clamp is fully opened and solution container is lowered below IV site
- **Management:**
  - Lower fluid reservoir to check for presence of backflow of blood into the tubing.
    Absence of backflow suggests infiltration
  - Discontinue IV infusion
  - Remove needle or catheter
  - Apply a pressure dressing to the site
  - Choose new site
  - Initiate IV therapy with new equipment
  - Document
  -

➢ **Air Embolism:**

- Uncommon but can be fatal → usually seen at the upper limb , subclavian and internal jugular vein placed catheter
- Air enters bloodstream through catheter tubing.
- In a peripheral line : you avoid the air embolism from the 30mmgh pressure in the vein which creates a +ve pressure
- In the cenral line always apply the catheter at heart level otherwise if it was above and open the risk of air emboli is higher
- Risk greatest with catheter in central circulation

- Negative pressure may pull air in.
- **Air can enter circulation:**
  - During catheter insertion
  - If tubing is disconnected
- **If enough air enters the heart chamber:**
  - Blood flow is impeded
  - Shock develops

➢ **Signs and symptoms:**

- Hypotension→ first sign , because the right ventricle is not pumping
- Cyanosis
- Weak and rapid pulse
- Loss of consciousness
- Intra-operativly there is a sudden drop in the end tidal Co^2, arrhythmia and on auscultation there will be a wind mill murmur.

➢ **Management:**

- Close the tubing
- **Turn patient on left side with head down** → this directs the air to the apex of the heart and prevents it from reaching the pulmonary circulation
- Check tubing for leaks
- Administer100% Oxygen
- Notify medical direction

➢ **Femoral vein complications :**

- Local complications → main is contamination and the needle is short lived
- Systemic complications → risk of sepsis

➢ **Internal jugular and subclavian veins complications :**

- Local complications
- Systemic complications
  - Ideally the catheter should stop at the SVC and not the right atrium because it may hit the SA node and initiate an arrhythmia

Notes from the Booklet:

- Central venous cannulation is undertaken to provide venous access when :
  - the peripheral route is unavailable
  - measure central venous pressure
  - administer drugs
  - to provide parenteral nutrition.
- The right internal jugular vein is normally used as the veins are relatively straight on the right side of the neck and the thoracic duct is avoided.
- A strict aseptic technique with the patient in a head-down position is used. This fills the veins and avoids the risk of air embolism.
- if the patient is hypovolaemic it can be impossible to ballotte the vein.

IV Medications

- IV injection may be given in:
  - An established IV line
  - Heparin or saline lock
  - Implantable port
    Port-A-Cath (used in children for chemo) , Hickman catheter
  - Directly into the vein

- IV injections generally less than 5 mL.

➢ **IV push or IV bolus medications:**

- Prepare medication
- Cleanse administration port
- If no one-way valve in IV tubing, clamp line
- Inject drug at prescribed rate
- Resume IV flow
- Monitor patient

➢ **IV Infusion:**

Administered by:

- Adding drug to an infusing IV solution
- Dilute drug in larger volume of fluid
- Administer drug through in-line device
  Burette, Volutrol, infusion pump
- Intermittent infusion
  IV piggyback or secondary set

- **IV Injection Procedure:**
- Inject slowly (over 1-3 min)
- Rate depends on type of medication and patient response
- Give through one-way valves on IV tubing or clamp the tubing above injection site
- After injection, continue infusion of fluids

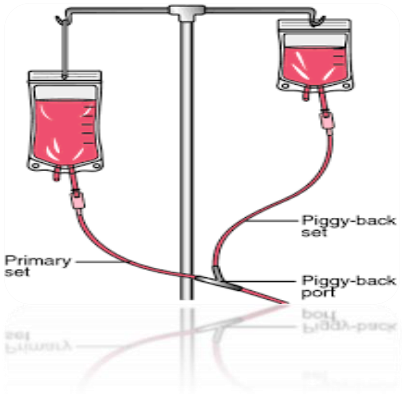
- **Adding Medication to IV Reservoir:**
- **Compute volume of drug to be added**
- Draw up dose in syringe
- Cleanse rubber sleeve of fluid reservoir
- Puncture rubber sleeve and inject medication
- Withdraw needle
- Discard needle and syringe
  Agitate reservoir to mix

- **Label fluid reservoir with:**
    1. Name of medication
    2. Amount of medication
    3. Concentration of medication in reservoir
    4. Date, time, and paramedic who prepared infusion
- Calculate rate in drops per minute

  - **Volume-Control IV Devices:**
- Permit accurate delivery of IV medications
- Electronic flow-rate regulators

    Regulate precise doses of drugs that can cause toxicity
    Vasopressors
    Antidysrhythmics
- Follow manufacturer's instructions
  - **Intermittent Infusion:**
- IV piggybacks
- Setup is secondary to primary IV infusion
- Piggyback medication hung in tandem and connected to primary setup
- To administer:
    - Prepare medication
    - Add to secondary fluid
    - Flush air out of second administration set
    - Attach a 1-inch, 18-gauge needle

        Use needle-free connection if possible
    - Cleanse medication port of primary infusion tubing
    - Connect piggyback medication
    - Tape securely to medication port
    - Calculate rate of secondary infusion
        - Drops per minute
    - Lower primary infusion reservoir
        - Center of gravity lower than secondary infusion reservoir



    - Open piggyback line flow clamp
    - Adjust flow rate
    - Clamp tubing of primary infusion
    - Allow piggyback medication to infuse
    - After drug administration, restart primary infusion is restarted
    - Discard piggyback equipment
    - Label bag with the medication

➢ **Drug Pump**

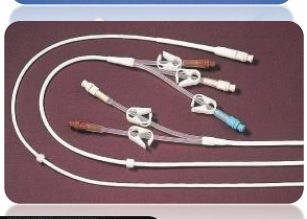
- Slow injection of medication
- Syringe with battery attachment that regulates injection of medication
- To administer medication SC:

- Can attach to indwelling vascular devices
    - Port-A-Cath
    - Hickman catheter

➢ **Indwelling Vascular Devices**

- Heparin or saline lock

- Single-, dual-, and triple-lumen catheters



➢ Ultrasound guided IV insertion

Arterial Access: from the booklet

- Commonly performed via the radial artery with a 20 or 22 gauge cannula.
- Complications of arterial cannulation include:
- Thrombosis
- Infection
- Fistula
- Aneurysm
- Distal ischemia.
- Color coding of arterial cannula and their dedicated infusion tubing with red tags and red three-way taps should be undertaken if possible. This reduces the risk of inadvertent injection of drugs into arteries. We have seen the results of such accidents – gangrenous fingers are most unpleasant.

Summary

- Five patient "rights" of drug administration
    - Drug
    - Dose
    - Patient
    - Route
    - Time
    - Correct and thorough documentation (sixth patient right of drug administration)
- Common causes for medication errors :
    - Wrong dose ordered by the prescriber→ should be checked by pharmacy and nurses
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- **Disinfectants**
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- Applied to living tissue
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- Route of choice for fluid replacement is peripheral vein in an extremity
- Large-bore catheter used for fluid replacement→14 to 16 gauge
- Smaller bore catheter used for "keep open" lines (continuous fluid)→18 to 20 gauge

For mistakes or feedback

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