Chapter 6

Venous Access

Chapter Goal

- Understand basic principles of venous access & IV therapy, as well as relate importance of employing appropriate BSI precautions when employing these precautions

Learning Objectives

- Describe indications, equipment needed, techniques used, precautions, & general principles of:
  - Peripheral venous cannulation
  - Obtaining blood sample
  - External jugular cannulation
  - Disposal of contaminated items & “sharps”
Introduction

- Intravenous (IV) cannulation
  - Placement of catheter into vein
  - Used to administer:
    - Blood
    - Fluids
    - Medications
  - Used to obtain blood samples
  - Medical direction or standing orders typically required

Indications:
- Cardiac disease
- Hypoglycemia
- Seizures
- Shock
  - Hypovolemic shock—to counter blood loss
  - Medical emergencies—to establish route for medication administration
  - Administer drugs in prehospital setting
  - Precautionary measure

Precautions:
- Bleeding
- Infiltration
- Infection

Contraindications:
- Sclerotic veins
- Burned extremities
- Do not delay transport to start IV
Introduction

- Body substance isolation precautions
  - Substances potentially infected with
    - Hepatitis B virus (HBV)
    - Human immunodeficiency virus (HIV)
  - Wash hands:
    - Before & after
    - Immediately on contact
  - Wear gloves, gown, mask, eye protection
  - HBV vaccine

Introduction

- Needle stick injuries
  - 600,000 to 800,000 per year
    - Hepatitis C & AIDS
  - Devices to help reduce risk
    - Needleless systems—no needle
    - Needle safety systems—built-in physical attribute
  - Passive & active devices
    - Active device requires activation
    - Passive device does not

Introduction

- Rules for avoiding injuries:
  - Use alternatives
  - Assist in selecting & evaluating devices
  - Use safety devices provided
  - Proper handling, disposal, use of barriers
  - Avoid recapping, bending, breaking, recapping needles
  - Avoid separating from syringe, manipulating by hand
  - Safe handling & disposal
  - Dispose of used needles promptly
  - Report injuries
  - Tell employer about hazards
  - Attend training
Introduction

- IV supplies & equipment
  - IV solution
  - Administration set
  - Extension set
  - Needles, catheters
  - Gloves, gown, goggles
  - Tourniquet
  - Tape, dressing
  - Antibiotic swabs, ointment
  - Gauze dressings
  - Syringes
  - Vacutainer
  - Blood tubes
  - Armboards

Introduction

- IV Solutions
  - Solutions & osmotic pressure
    - Described by tonicity
    - Isotonic solution
    - Hypotonic solution
    - Hypertonic solution
  - Crystalloids
    - Normal saline
    - Lactated Ringer's

Introduction

- Crystalloids
  - Dissolved ions cross cell membrane
  - Sodium chloride 0.9% solution/lactated Ringer's solution
  - 5% dextrose in water (D5W)
Introduction

- Sodium chloride 0.9% solution & lactated Ringer’s solution
  - Recommended IV use in prehospital setting
  - Used to:
    - Expand intravascular volume
    - Replace extracellular fluid losses
    - Administer with blood products—only solution

- 5% dextrose in water (D5W)
  - Was mainstay in management of medical emergencies
    - In cardiac arrest—no longer considered preferred
    - Slightly acidotic
    - Local EMS protocols will dictate

Introduction

- IV solution containers
  - Size of bag varies

Introduction

- IV solution containers
  - 2 ports at bottom of bag
  - Labeled with:
    - Contents
    - Expiration date
Introduction

- Administration set
  - Clear plastic tubing
    - Range from 60–110 inches

Introduction

Piercing spike

Introduction

Microdrip
Macro drip
Introduction

- Rates for administering IV fluids
  - Medical emergencies—TKO rate
  - Trauma—based on patient’s response

Introduction

- Changing philosophy for hypovolemic shock—no clear rule
  - Shock, external bleeding uncontrolled—only enough to maintain BP
  - Uncontrolled internal bleeding—surgical intervention
  - Regardless of flow rate—limited to 2–3 L
Introduction

- Blood tubing
  - Some EMS systems use in patients with hypovolemia
  - EMTs who work in critical care areas
  - 2 types of blood tubing
    - Y-tubing
    - Straight tubing

Introduction

- Volume control
  - Volutrol chamber
    - For specific amount of fluid to be administered
    - Pediatrics
    - Renal failure
    - Administer precise medications
Introduction

- Volume control chamber IV tubing

Equipment

- Protected Needles
  - Shielding/Retracting
  - Self-blunting

- IV Catheter Size
  - Outside diameter is “gauge”
  - Larger gauge number—smaller diameter
  - Large diameter—greater fluid flow
  - Color-coded system
### Equipment

- **Choosing best size over-the-needle catheter**
  - Smaller-sized devices are better
  - Except for volume replacement
  - Causes less injury
  - Allows greater blood flow
- **Large-bore catheters**
  - Shock
  - Cardiac arrest
  - Viscous medications
  - Life-threatening emergencies—rapid fluid replacement
  - Minimum 18-gauge catheter—patients requiring blood
- **Catheter’s length**—longer catheter = slower rate

### Equipment

- **Other supplies & materials**
  - Latex, rubber or nonlatex gloves
  - Tourniquet
  - Alcohol preparations
  - Sterile dressings
  - Adhesive tape
  - Commercial transparent dressings
  - Armboards
  - 10 or 35-mL syringe or Vacutainer
  - Assorted blood collection tubes

### Equipment

- **Intermittent infusion device**
  - Eliminates need for IV bag & administration
  - Keeps access device sterile
  - Self-sealing
  - Constant venous access—not continuous infusion
Equipment

- IV solution warming devices
  - Temperature of IV fluids vary
  - Infusion < normal body temperature
  - Appliances designed to:
    - Maintain IV fluid at normal body temperature
    - Prevent overheating
  - Hot sack

Peripheral Venous Cannulation

- Veins have 3 layers—Tunica intima, Tunica media, Tunica adventitia

Peripheral Venous Cannulation

- Skin has 2 layers
  - Epidermis
    - Outermost layer
    - Protective covering
    - Varies in thickness
  - Dermis
    - Highly vascular & sensitive
    - Many capillaries
    - Thousands of nerve fibers
Peripheral Venous Cannulation

- Noncritical patients
  - Distal veins on dorsum of hands and arms

- Use vein with these characteristics:
  - Fairly straight
  - Easily accessible
  - Well-fixed—not rolling
  - Feels springy

Sites to be avoided:
- Sclerotic veins
- Veins near joints
- Areas where arterial pulse is palpable
- Veins near injured areas
- Veins near edematous extremities
Peripheral Venous Cannulation

- Sites used in cardiac arrest:
  - Peripheral veins of antecubital fossa
    - Largest
    - Most visible
    - Most accessible
  - Distal veins are least desirable
    - Blood flow markedly diminished
    - Difficult or impossible to cannulate

- Other sites
  - External jugular vein
  - Peripheral leg veins
  - Intraosseous

Performing IV Cannulation

- Insert spiked piercing end of administration set into tubing of IV bag
- Squeeze drip chamber to fill halfway
Performing IV Cannulation

- Place tourniquet 6 inches above venipuncture site
- Make slip knot with tourniquet

Performing IV Cannulation

- Complete band placement
- Use povidone-iodine (use protocol) or alcohol wipe to cleanse site

Performing IV Cannulation

- Pull skin taut; bevel of needle should be facing up
- Penetrate vein either from top or side
Performing IV Cannulation

- Watch for blood in flashback chamber
- Advance needle until tip of catheter is sufficiently within vein
- Slide catheter into vein until hub rests against skin

Performing IV Cannulation

- Remove needle from vein & catheter
- Properly dispose of used needle

Performing IV Cannulation

- Draw sample of blood
- Release tourniquet
Performing IV Cannulation

- Open IV control valve; ensure IV fluid is flowing properly
- Secure catheter & tubing with tape/commercial device

Performing IV Cannulation

- After venipuncture is performed:
  - Confirm needle placement
  - Blood may not flow back
  - If infiltration occurs:
    - Remove & discard catheter
    - Place dressing on venipuncture site
    - Attempt venipuncture at another site
  - Other methods of determining proper placement of catheter:
    - Lower IV bag below IV site
    - Palpating vein above IV site
    - Palpating tip of catheter in vein
    - Aspirating blood with 10-mL syringe

Peripheral IV Access
Performing IV Cannulation

- Using an armboard
  - Can be avoided—choose site away from flexion areas
  - May be necessary when:
    - Venipuncture device inserted near joint
    - Venipuncture device inserted in dorsum of hand
    - Used along with restraints

Performing IV Cannulation

- Regulating fluid flow rates
  - Primary aspect
  - Too fast or too slow—cause complications
  - Adjust according to protocol
  - Formula
  - Flow rate established—check on ongoing basis

Performing IV Cannulation

- Regulating fluid flow rates
  - Factors that can cause flow rate to vary:
    - Vein spasm
    - Vein pressure changes
    - Patient movement
    - Manipulations of clamp
    - Bent, kinked tubing
    - IV fluid viscosity
    - Height of infusion bag
    - Type of administration set
    - Size & position of venous access device
Performing IV Cannulation

- Regulating fluid flow rates
  - Assess flow rate more frequently
  - Condition can be exacerbated by fluid overload
  - Pediatric patients
  - Elderly patients
  - Patients receiving drug that can cause tissue damage if infiltration occurs

Performing IV Cannulation

- Document
  - Date/time
  - Type/amount of solution
  - Type of device used
  - Venipuncture site
  - Number of attempts & location for each
  - IV flow rate
  - Adverse reactions & actions taken
  - Name/identification number of person initiating infusion

When IV Fluid Does Not Flow
Performing IV Cannulation

- Complications
  - Pain
  - Catheter shear
  - Circulatory overload
  - Cannulation of artery
  - Hematoma or infiltration
  - Local infection
  - Air embolism
  - Pyrogenic reaction

Intermittent Infusion Device

- Prime device with dilute heparin/saline solution
- Cannulate vein

Intermittent Infusion Device

- Connect intermittent device to hub of IV catheter
- Connect saline/heparin-filled syringe to access port
  - Slowly aspirate until blood is seen
  - Inject 3–5mL dilute heparin/saline
### Drawing Blood

- Acquire blood samples for analysis
- Commonly used in field setting
- Draw samples immediately after venipuncture
- Blood-drawing equipment

### Drawing Blood

- Variety of sizes & types
- Several colors & patterns
- During manufacture—vacuum created
- Filled by drawing blood from vein with syringe
- Tube filled completely
- Tube labeled
- Stored in plastic “zip-lock” bag

### Changing IV Bag

- Typically occurs when directed to continue IV after bag is empty

**Steps**
- Remove cover from IV tubing port
- Occlude flow
- Remove spike
- Insert spike into new IV bag
- Open roller clamp to appropriate flow rate
Discontinuing IV Line

- Close flow control valve completely
- Do not disturb catheter—remove dressing
- Hold 2 x 2 dressing above site to stabilize tissue while withdrawing catheter
- Remove catheter by pulling straight back
- To prevent blood loss
  - Cover site with 2 x 2 dressing
  - Hold against puncture site until bleeding stopped
  - Tape dressing in place

Using IV Protective Devices

- Penetrate skin, vein with over-the-needle device
- Slide catheter forward into vein while withdrawing needle
- Clicks into place once plastic guard reaches end
- Separate plastic guard from catheter hub
- Needle is retracted fully within protective sheath
Preparing Volume Control Setups

Open upper control valve
Open bottom flow clamp

External Jugular Vein Cannulation

- Benefits
  - Fairly easy to cannulate
  - Fluids & meds quickly reach central circulation & heart

- Disadvantages
  - Hard to access when managing patient's airway
  - Vein can "roll"
  - Vein can be positional
  - Extremely painful

- Complications
  - Same as with other veins
  - Risk of puncturing thoracic cavity
  - Structures can be damaged by accidental misplacement
Elderly Patients

- Prominent veins—less resistant skin
- Difficult to stabilize vein
- Veins fragile
- Remove tourniquet quickly
- Smaller, shorter venipuncture devices work best

Seizing or Moving Patients or Patients in Transport

- Steady extremity
- Look for biggest vein
- Penetrate during period of less movement.
- Hold little & ring fingers against patient’s extremity
- Once in—slide catheter in quickly

Seizing or Moving Patients or Patients in Transport

- Once in place—do not let go
- Use extra tape to secure cannula
- Use armboard or splint
- Wrap tubing & extremity proximal to site
Summary

- IV cannulation—placement of catheter into vein for purpose of administering blood, fluids, or medications &/or obtaining venous blood specimens
- Placement of IV line should not significantly delay transporting critically ill or injured patients to hospital
- Recommended IV solutions for use in prehospital setting—normal saline (0.9%) & lactated Ringer’s solution
- Crystalloid solutions quickly diffuse out of circulatory system
- 2 most common types of administration sets—microdrip, macrodrip

Summary

- Most commonly, plastic over-the-needle catheters are used in prehospital setting
- Noncritical patients—distal veins of dorsal aspect of hand & arms preferred
- Cardiac arrest—veins of antecubital fossa
- Patients in whom cannulating vein is difficult
  - Obese persons
  - Patients in shock or cardiac arrest
  - Chronic malnourished
  - Elderly patients
  - Small children

Summary

- When equipment selected—IV fluid checked
  - Right fluid
  - Not outdated
  - Clear
  - Bag has no leaks
- Continually employ infection control procedures
- Release tourniquet once IV tubing is connected
- Continually monitor patient for signs of improvement & signs of circulatory overload
- All IV techniques share number of complications