



MAINTENANCE OF PERIPHERAL INTRAVENOUS THERAPY  
FOR  
EMERGENCY MEDICAL TECHNICIANS

DOH 346-110

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## Course Description

A three-hour course for EMTs designed to provide basic knowledge and skills necessary to transport a patient with a pre-existing peripheral intravenous infusion.

## Equipment

- IV Administration Sets - micro and macro drip
- IV Fluids
- Tape
- Armboards
- IV Practice Arm
- IV Catheters
- 2x2's
- Alcohol or betadine wipes
- Sterile site stabilization dressing

## Course Objectives

At the completion of the course, the EMT will:

1. Maintain a continuous peripheral intravenous infusion at the ordered rate using aseptic techniques.
2. Monitor vital signs and patient condition to prevent complications.
3. Adequately stabilize tubing and venipuncture site for safe transport.
4. Properly adjust infusion at the ordered rate.
5. Change bag with aseptic techniques when 50 cubic centimeters (ccs) remain in existing bag.
6. Discontinue peripheral intravenous infusion when circumstances indicate
7. Record all procedures, assessments, patient condition and intake/output at regular intervals.

## Lesson Plan

- I. Role of EMT with IV maintenance training - **15 minutes**.
  - A. Transport of STABLE patient with peripheral IV.
    1. **NO MEDICATIONS** in IV or to be given en route, **NO BLOOD PRODUCTS**
    2. IV should be heparin or saline locked by hospital staff before transport if this will not be harmful to the patient.
    3. Ask the staff to hang a full bag before departure if required in local protocol..
  - B. Goals:
    1. Keep IV patent and infusing at ordered rate
    2. Prevent/monitor for complications:
      - a) Infiltration
      - b) Clot occlusion
      - c) Empty bag
      - d) Over-hydration
    3. Stable patient status (documented)
  - C. Body Substance Isolation/Universal Precautions
    1. Avoid contact with blood (infectious diseases)
    2. WASH HANDS before and after contact with blood.
    3. Needle stick injury from needle infusion device
      - a) Wash injury well
      - b) Report stick injury to supervisor and follow infectious control procedure
      - c) May need additional medical treatments
- II. Fluid administration - **15 minutes**
  - A. Purpose of IV fluids:
    1. Replacement of fluid losses
      - a) Vomiting
      - b) Diarrhea
      - c) Dehydration
    2. Maintenance of fluid and electrolyte balance
      - a) Patients who are nil per os or nothing by the mouth (NPO)
      - b) Patient is unable to take enough orally to meet needs
  - B. Major complications of IV fluid administration:
    1. Over-hydration, pulmonary edema, and congestive heart failure
      - a) Rales in lungs, shortness of breath (SOB) and tachypnea, dependent edema, irregular pulse and/or tachycardia, jugular vein distention (JVD) , possible hyper or hypotension
        - (1) Keep infusion open but reduce rate to 30cc/hr
        - (2) Contact medical assistance
        - (3) Keep patient in sitting position.
    2. Clot occlusion
      - a) If IV not infusing, catheter will clot over and occlude flow
        - (1) DO NOT FLUSH LINE
        - (2) Stop infusion
    3. Discontinue the IV Infiltration of IV fluid to the tissues
      - a) Extravasation at site appears cold, puffy and painful
      - b) IV does not infuse properly, no blood return
      - c) Stop infusion and discontinue the IV.

4. Positional IV
    - a) Reposition limb, tubing and/or catheter/tubing connection
    - b) Re-stabilize when flowing smoothly.
- III. Demonstration of equipment and techniques - **45 minutes**. The instructor will demonstrate the following:
- A. Stabilization of site and tubing
    - a) Cannula must be stabilized and the site covered (usually by hospital staff)
    - b) Two stress loops in tubing taped to avoid accidental extravasation
    - c) Armboard if indicated.
  - B. Adjusting rate of infusion (flow rate)
    1. Flow rate is influenced by
      - a) The height of the bag
      - b) Amount of fluid in the bag
      - c) Altitude during transport
      - d) Position of limb below level of the heart
    2. Calculate flow rate
      - a) Review metrics - 1 liter = 1000cc or 1000ml, 1cc = 1ml
      - b) Micro or macro administration sets - know drip factor (gtts/cc)
      - c) Formula to calculate flow rate in drops per minute (gtt/min):
        - (1)  $\text{gtts/min} = \text{vol. to be infused (in ccs)} \times \text{drip factor (in gtts per cc)} \div \text{total time of infusion (in minutes)}$
        - (2) Example: IV D51/2NS to run at 100cc/hr with tubing drip factor at 15 gtts/cc:
 
$$\frac{100 \text{ cc} \times 15 \text{ gtts/cc}}{60 \text{ min}} = \frac{1500 \text{ cc}}{60 \text{ min}} = 25 \text{ gtts / minute}$$
      - d) Adjust roller clamp
        - (1) Count drops for 15 seconds initially while adjusting
        - (2) Then count for full minute when ready to check
        - (3) May be 1-2 drops off for full minute and still be acceptable.
        - (4) Check the flow rate periodically.
  - C. Changing bag with aseptic technique when 50ccs remain in existing bag.
    1. Select solution
      - a) The proper solution
      - b) Clarity of fluid
    2. Check expiration date
    3. Clamp tubing before removing bag
    4. Remove bag
      - a) Keep tubing spike sterile
      - b) Keep solution bag access port sterile
    5. Replace bag
      - a) Keep tubing spike sterile
      - b) Keep solution bag access port sterile
    6. Readjust flow rate
    7. Note solution, rate and time hung
  - D. Discontinuing of IV if extravasated or clot occluded using aseptic technique
    1. Have sterile 2x2 and tape ready
    2. Remove IV catheter and quickly place 2x2 over puncture site
    3. Hold direct pressure over site for a minute or two until bleeding stops

4. Tape 2x2 in place
  5. **CHECK** that the removed IV catheter is intact
    - a) If catheter is not intact
      - (1) Tourniquet limb above site to impede venous return
      - (2) Call for medical assistance. (Catheter embolus is a potentially fatal complication).
  6. Dispose of catheter/needle in proper container
- IV. Recording and documentation - **15 minutes**
- A. Record the following at least hourly
    1. Vital signs
    2. Lung sounds
    3. Condition of IV site
    4. Amount of fluid infused
    5. Amount of fluid remaining in the bag (L.I.B.)
  - B. Record amount of ccs of any urine output or emesis
  - C. Record any oral intake of fluid in ccs
  - D. Record solution and time when hanging a new bag
  - E. Record time IV catheter removed and length of catheter if IV discontinued
- V. Practice - **50 minutes**
- A. Stabilization of site and tubing
  - B. Infusion rate
    1. Calculation of flow rate - micro- and macro-drip
    2. Adjust flow rate - micro- and macro-drip
  - C. Changing bag with sterile technique
  - D. Discontinuing IV with aseptic technique
  - E. Record and document
- VI. Testing - **40 minutes**
- A. Written test - to include flow rate calculations as well as other didactic material.
  - B. Practical skills
    1. Stabilize site and tubing
    2. Adjust flow to specified rate - both micro and macro
    3. Change bag using aseptic technique, record
    4. Discontinue IV and record

# Intravenous (IV) Monitor/Maintenance Skill Sheet

Candidate Name \_\_\_\_\_ Date \_\_\_\_\_

Scenario \_\_\_\_\_ Actual Time Started: \_\_\_\_\_

Points      Points

	Possible	Awarded
* Takes or verbalizes appropriate PPE precautions	1	
<b>Continue IV infusion per local protocol</b> -Assures infusion site and tubing are stabilized (1 point) -Appropriately positions IV bag and roller clamp (1 point) * -Accurately adjusts flow rate in drops per minute (1 point) -Verbalizes documentation of time, fluid infused and remaining fluid (1 point)	4	
<b>Replacing IV solution bag</b> * -Selects proper solution (1 point) * -Checks for clarity or particulate matter (1 point) * -Checks expiration date (1 point) -Clamps tubing before removing empty bag (1 point) -Removes empty maintaining sterility of IV tubing spike (1 point) -Replaces spike into new bag, maintaining sterility of port and spike (1 point) * -Accurately adjusts flow rate in drops per minute (1 point) -Verbalizes documentation of solution, flow rate and time hung (1 point)	8	
<b>Discontinuing IV infusion</b> -Verbalizes reason to discontinue infusion (1 point) -Gathers and prepares supplies (2x2 gauze and tape) (1 point) -Clamps tubing (1 point) -Removes tape/dressing gently (1 point) -Removes catheter safely and smoothly with 2x2 gauze immediately placed on puncture site (1 point) * -Applies pressure 1-2 minutes at puncture site until bleeding stops (1 point) -Secures sterile dressing over puncture site (1 point) * -Inspects catheter for integrity and contacts medical direction as needed (1 point) -Verbalizes documentation of catheter integrity, solution type, time, and amount of fluid infused (1 point)	9	
<b>Passing score is 18 (at least 80%)</b>	<b>TOTAL:</b>	<b>22</b>

Actual Time Ended: \_\_\_\_\_ Elapsed Time: \_\_\_\_\_ Max Time Allowed: 10      PASS / FAIL

CRITICAL CRITERIA - Note: Blocks above with an \* have corresponding Critical Criteria below.

- \_\_\_ Failure to take or verbalize appropriate PPE precautions
- \_\_\_ Failure to select proper solution
- \_\_\_ Failure to check solution for clarity, particulate matter and expiration date
- \_\_\_ Contaminates equipment or site without appropriately correcting the situation
- \_\_\_ Failure to accurately adjust flow rate in drops per minute
- \_\_\_ Failure to take or verbalize appropriate PPE precautions
- \_\_\_ Failure to inspect catheter for integrity and contact medical direction as needed
- \_\_\_ Failure to manage the patient as a competent EMS provider
- \_\_\_ Exhibits unacceptable affect with patient or other personnel
- \_\_\_ Uses or orders a dangerous or inappropriate intervention

You must factually document your rationale for checking any of the above critical items on the form.

Evaluator Name: \_\_\_\_\_  
Printed
Signature



## Evaluator Notes

PROS	CONS

ADDITIONAL COMMENTS:

## Example of Peripheral Intravenous Infusion Maintenance Basic Life Support (BLS) Field Protocols

1. Body Substance Isolation
2. Check patency and type of infusion solution.
3. Stabilization:
  - a) Dressing over insertion site
  - b) Stabilize limb on armboard if necessary
  - c) Stabilize tubing with two stress loops
4. Fluids:
  - a) Start with full bag of prescribed solution hung by hospital staff.
  - b) Adjust flow rate to prescribed rate
  - c) Replace bag with sterile technique when 50ccs remain in current bag and readjust flow rate
  - d) Adjust flow rate as needed and at least hourly
5. Patency:
  - a) Observe for patency as necessary and record
  - b) Avoid kinks in tubing, pressure over or near insertion site
  - c) Observe insertion site for infiltration and extravasation
  - d) Consider possibility of clot occlusion if not patent and no other reason for lack of flow
6. Discontinuing an infiltrated or occluded IV:
  - a) Turn infusion off via roller clamp
  - b) Gently and systematically remove tape
  - c) Remove catheter and quickly cover with sterile 2x2
  - d) Immediately observe for intact catheter
  - e) Hold direct pressure over insertion site for 1-2 minutes until bleeding stops
  - f) Secure 2x2 over site with tape or band aid
  - g) If catheter is not intact and a portion is missing, assume catheter embolus and immediately tourniquet limb well above insertion site, keep limb in dependent position and immediately seek medical intervention
7. Patient assessment:
  - a) Respiratory and cardiovascular status assessed at start and as necessary throughout transport
  - b) Fluids in and out, fluid remaining in bag checked and recorded hourly
  - c) Condition of infusion site checked frequently and recorded at least hourly

## Final Examination

1. The patient has 500cc remaining of D5W hanging with a medication label that says Aminophylline 1000 mg. Your best action would be to:
  - a. Ask the nurse to hang a full bag.
  - b. Tell the nurse you cannot transport a patient with medication in the IV.
  - c. Change the bag to plain D5W as soon as you get in the ambulance.
  - d. Transport the patient.
2. The patient has an I.V. order for D5 1/2 NS to run at 100cc/hr. The infusion set delivers 15 drops per cc. You adjust the roller clamp to \_\_\_\_\_ drops per minute.
  - a. 25
  - b. 30
  - c. 100
  - d. 15
3. Which of the following indicate potential local infiltration at the infusion site?
  - a. Edema and pain at the infusion site.
  - b. Decreased infusion rate.
  - c. Absence of blood return.
  - d. All of the above.
4. Circulatory overload or over-hydration is characterized by:
  - a. Rales in the lungs, ankle edema.
  - b. Decreased infusion rate.
  - c. Absence of blood return.
  - d. All of the above.
5. The I.V. infusion is not dripping at all. There is 500cc remaining in the bag. The roller clamp is open, the tubing is patent and unknicked, the insertion site is without apparent problem but there is no blood return. The problem probably is:
  - a. Infiltration
  - b. Clot occlusion
  - c. Too much backpressure
  - d. Dehydration
6. The chief reason to replace the solution bag before it is completely empty is:
  - a. To save a specimen of the infusion.
  - b. To prevent air embolism.
  - c. To prevent backpressure.
  - d. None of the above.

Scenario for question 7 & 8.

The patient you are transporting is a 79-year-old male who begins to have moist, labored respirations. Apical pulse is 110 and irregular and appears slightly cyanotic.

7. You suspect that the problem is:
  - a. Overhydration and possible congestive heart failure.
  - b. Pneumonia.
  - c. A myocardial infarction beginning.
  - d. Mitral valve prolapse.
  
8. Indicate the correct sequence of actions:
  1. Contact medical assistance on the radio
  2. Supplemental O<sub>2</sub> at 2 liters N.C.
  3. Listen to lung sounds
  4. Vital signs
  5. Decrease I.V. to 30 cc/hr.
  6. Place patient in semi Fowlers (45 degree) position.
    - a. 1,2,4,3,5,6
    - b. 4,3,2,5,1,6
    - c. 6,2,4,3,5,1
    - d. 1,4,3,2,5,6
  
9. You determine that an I.V. in the dorsum of the right hand is infiltrated. After removing the catheter, you note that the catheter is bent in several places due to movement of the wrist. It also appears that the tip is not there. Your first action is to:
  - a. Ask for a second opinion from the driver to be sure.
  - b. Check to see if this was a short catheter length at the start.
  - c. Call for instructions on the radio.
  - d. Tourniquet the arm and keep it lower than the heart.
  
10. The infusion solution bag must be changed. The part of the tubing to be kept sterile during this procedure is:
  - a. The spike
  - b. The drip chamber
  - c. The roller clamp
  - d. None of the above
  
11. The purpose of taping stress loops in I.V. tubing is primarily
  - a. To decrease the awkward length of tubing.
  - b. To decrease the chance of accidental extravasation of the catheter.
  - c. To slow down the drip rate of the infusion.
  - d. To cover the insertion site.

12. Vital signs, lung sounds, condition of I.V. insertion site, amount of fluids infused and amount remaining in the bag should be assessed and recorded during transport:
- At least hourly and prn.
  - Every 15 minutes throughout transport.
  - Every 5 minutes x 4, then every 15 minutes x 4, then hourly.
  - At the beginning and at the end.

TRUE or FALSE: Mark T for True, F for False

13. \_\_\_\_\_ The flow rate is influenced by changes in altitude as well as the roller clamp adjustment.
14. \_\_\_\_\_ Lowering the height of the solution bag will speed up the drip rate.
15. \_\_\_\_\_ If you suspect a clot occlusion, flush the line with saline to dislodge the clot.

CALCULATIONS: Please show your work. Answer in drops per minute.

16. Order: IV D5 1/2NS at 100cc/hr. Tubing delivers 20 drops per cc.
17. Order: IV D5 Normal saline -M 1 liter q. 8 hours. Tubing delivers 15 drops/cc.
18. Order: IV 1000cc D5W q. 12 hours. Tubing delivers 15 drops/cc.
19. Pediatric Order: IV D5 1/4NS at 50cc/hour. Tubing delivers 60 drops per cc.
20. Order: D5 1/2NS with 20 mEq KCL at 75cc/hour. Tubing delivers 20 drops per cc.