

## MANAGING SYSTEMIC COMPLICATIONS

IV therapy predisposes the patient to numerous hazards, including both local and systemic complications.

**Fluid Overload.** Overloading the circulatory system with excessive IV fluids causes increased blood pressure and central venous pressure. Signs and symptoms of fluid overload include moist crackles on auscultation of the lungs, edema, weight gain, dyspnea, and respirations that are shallow and have an increased rate. The treatment for circulatory overload is decreasing the IV rate, monitoring vital signs frequently, assessing breath sounds, and placing the patient in a high Fowler's position.

**Air Embolism.** The risk of air embolism is rare but ever-present. It is most often associated with cannulation of central veins. Manifestations of air embolism include dyspnea and cyanosis; hypotension; weak, rapid pulse; loss of consciousness; and chest, shoulder, and low back pain. Treatment calls for immediately clamping the cannula, placing the patient on the left side in the

Trendelenburg position, assessing vital signs and breath sounds, and administering oxygen. Air embolism can be prevented by filling all tubing completely with solution, and using an air detection alarm on an IV pump. Complications of air embolism include shock and death.

**Septicemia and Other Infection.** Pyrogenic substances in either the infusion solution or the IV administration set can induce a febrile reaction and septicemia. Signs and symptoms include an abrupt temperature elevation shortly after the infusion is started, backache, headache, increased pulse and respiratory rate, nausea and vomiting, diarrhea, chills and shaking, and general malaise. In severe septicemia, vascular collapse and septic shock may occur. Causes of septicemia include contamination of the IV product or a break in aseptic technique, especially in immunocompromised patients. Treatment is symptomatic and includes culturing of the IV cannula, tubing, or solution if suspect and establishing a new IV site for medication or fluid administration. infusion. Prevention includes:

- Careful hand hygiene before every contact with any part of the infusion system or patient
- Examining the IV containers for cracks, leaks, or cloudiness, which may indicate a contaminated solution
- Using strict aseptic technique

Replacing the peripheral IV cannula every 48 to 72 hours,  
or as indicated

- Replacing the IV cannula inserted during emergency conditions (with questionable asepsis) as soon as possible
- Using a 0.2-micron air-eliminating and bacteria/particulate retentive filter with non-lipid-containing solutions that require filtration. The filter can be added to the proximal or distal end of the administration set. If added to the proximal end between the fluid container and the tubing spike, the filter ensures sterility and particulate removal from the infusate container and prevents inadvertent infusion of air. If added to the distal end of the administration set, it filters air particles and contaminants introduced from add-on devices,

secondary administration sets, or interruptions to the primary system.

- Replacing the solution bag and administration set in accordance with agency policy and procedure
- Infusing or discarding medication or solution within 24 hours of its addition to an administration set
- Changing primary and secondary continuous administration sets every 72 hours, or immediately if contamination is suspected
- Changing primary intermittent administration sets every 24 hours, or immediately if contamination is suspected.

### MANAGING LOCAL COMPLICATIONS

Local complications of IV therapy include infiltration and extravasation, phlebitis, thrombophlebitis, hematoma, and clotting of the needle

**Infiltration and Extravasation.** Infiltration is the unintentional administration of a nonvesicant solution or medication into surrounding tissue. This can occur when the IV cannula dislodges or perforates the wall of the vein. Infiltration is characterized by edema around the insertion site, leakage of IV fluid from the insertion site, discomfort and coolness in the area of infiltration, and a significant decrease in the flow rate. When the solution is particularly irritating, sloughing of tissue may result. Closely monitoring the insertion site is necessary to detect infiltration before it becomes severe. A warm compress may be applied to the site if small volumes of noncaustic solutions have infiltrated over a long time, and the affected extremity should be elevated to promote the absorption of fluid.

**Phlebitis.** Phlebitis is defined as inflammation of a vein related to a chemical or mechanical irritation, or both. It is characterized by a reddened, warm area around the insertion site or along the path of the vein, pain or tenderness at the site or along the vein, and swelling. Treatment consists of discontinuing the IV and restarting it in another site, and applying a warm, moist compress to the affected site. Phlebitis can be prevented by using aseptic technique during insertion, using the appropriate-size cannula or needle for the vein.

**Thrombophlebitis.** Thrombophlebitis refers to the presence of a clot plus inflammation in the vein. It is evidenced by localized pain, redness, warmth, and swelling around the insertion site or along the path of the vein, immobility of the extremity because of discomfort and swelling, sluggish flow rate, fever, malaise, and leukocytosis. Treatment includes discontinuing the IV infusion, applying a cold compress first to decrease the flow of blood and increase platelet aggregation followed by a warm compress, elevating the extremity, and restarting the line in the opposite extremity.

**Hematoma.** Hematoma results when blood leaks into tissues surrounding the IV insertion site. Leakage can result from perforation of the opposite vein wall during venipuncture, the needle slipping out of the vein, and insufficient pressure applied to the site after removing the needle or cannula. The signs of a hematoma include ecchymosis, immediate swelling at the site, and leakage of blood at the site. Treatment includes removing the needle or cannula and applying pressure with a sterile dressing; applying ice for 24 hours to the site to avoid extension of the

hematoma and then a warm compress to increase absorption of blood; assessing the site; and restarting the line in the other extremity if indicated. A hematoma can be prevented by carefully inserting the needle and using diligent care when a patient has a bleeding disorder, takes anticoagulant medication, or has advanced liver disease.

### **Isotonic Fluids**

Fluids that are classified as isotonic have a total osmolality close to that of the ECF and do not cause red blood cells to shrink or swell. The composition of these fluids may or may not approximate that of the ECF. Isotonic fluids expand the ECF volume. One liter of isotonic fluid expands the ECF by 1 L; however, it expands the plasma by only 0.25 L because it is a crystalloid fluid and diffuses quickly into the ECF compartment. For the same reason, 3 L of isotonic fluid is needed to replace 1 L of blood loss. Because these fluids expand the intravascular space, patients with hypertension and heart failure should be carefully monitored for signs of fluid overload.

### **OTHER ISOTONIC SOLUTIONS**

Several other solutions contain ions in addition to sodium and chloride and are somewhat similar to the ECF in composition. Lactated Ringer's solution contains potassium and calcium in addition to sodium chloride. It is used to correct dehydration and sodium depletion and replace GI losses. Lactated Ringer's solution contains bicarbonate precursors as well. These solutions are marketed, with slight variations, under various trade names.

### **Hypotonic Fluids**

One purpose of hypotonic solutions is to replace cellular fluid, because it is hypotonic as compared with plasma. Another is to provide free water for excretion of body wastes. At times, hypotonic sodium solutions are used to treat hypernatremia and other hyperosmolar conditions. Half-strength saline (0.45% sodium chloride) solution, with an osmolality of 154 mOsm/L, is frequently used. Multiple-electrolyte solutions are also available. Excessive infusions of hypotonic solutions can lead to intravascular fluid depletion, decreased blood pressure, cellular edema, and cell damage. These solutions exert less osmotic pressure than the ECF.

### **Hypertonic Fluids**

Higher concentrations of dextrose, such as 50% dextrose in water, are administered to help meet caloric requirements. These solutions are strongly hypertonic and must be administered into central veins so that they can be diluted by rapid blood flow.

Saline solutions are also available in osmolar concentrations greater than that of the ECF. These solutions draw water from the ICF to the ECF and cause cells to shrink.

## **Blood Transfusion**

### **Preprocedure**

1. Confirm that the transfusion has been prescribed.
2. Check that patient's blood has been typed and cross-matched.
3. Verify that patient has signed a written consent form according to the agency policy.

4. Explain the procedure to the patient. Instruct patient in signs and symptoms of transfusion reaction (itching, hives, swelling, shortness of breath, fever, chills).
5. Take patient's temperature, pulse, respiration, and blood pressure to establish a baseline for comparing vital signs during transfusion.
6. Use hand hygiene and wear gloves in accordance with Standard Precautions.
7. Use a 20-gauge or larger needle for placement in a large vein. Use special tubing that contains a blood filter to screen out fibrin clots and other particulate matter. Do not vent the blood container.

### **Procedure**

1. Obtain the PRBCs from the blood bank *after* the intravenous line is started. (Institution policy may limit release to only 1 unit at a time.)
2. Double-check the labels with another nurse or physician to make sure that the ABO group and Rh type agree with the compatibility record. Check to see that the number and type on the donor blood label and on the patient's chart are correct. Check the patient's identification by asking the patient's name and checking the identification wristband.
3. Check the blood for gas bubbles and any unusual color or cloudiness. (Gas bubbles may indicate bacterial growth. Abnormal color or cloudiness may be a sign of hemolysis.)
4. Make sure PRBC transfusion is initiated within 30 min after removal of the PRBCs from the blood bank refrigerator.
5. For first 15 minutes, run the transfusion slowly—no faster than 5 mL/min. Observe the patient carefully for adverse effects. If no adverse effects occur during the first 15 min, increase the flow rate unless the patient is at high risk for circulatory overload.
6. Monitor closely for 15–30 min to detect signs of reaction. Monitor vital signs at regular intervals per institution policy; compare results with baseline measurements. Increase frequency of measurements based on patient's condition. Observe the patient frequently throughout the transfusion for any signs of adverse reaction, including restlessness, hives, nausea, vomiting, torso or back pain, shortness of breath, flushing, hematuria, fever, or chills. Should any adverse reaction occur, stop infusion immediately, notify physician, and follow the agency's transfusion reaction standard.
7. Note that administration time does not exceed 4 hr because of the increased risk for bacterial proliferation.
8. Be alert for signs of adverse reactions: circulatory overload, sepsis, febrile reaction, allergic reaction, and acute hemolytic reaction.
9. Change blood tubing after every 2 units transfused, to decrease chance of bacterial contamination.

### **Post procedure**

1. Obtain vital signs and compare with baseline measurements.
2. Dispose of used materials properly.
3. Document procedure in patient's medical record, including patient assessment findings and tolerance to procedure.
4. Monitor patient for response to and effectiveness of the procedure.