Hemodialysis: Air Embolus During Hemodialysis

Site Applicability

PHC hemodialysis units

Practice Level

Specialized: Nurses (RN and LPN) who have completed the required education and provide nursing care in a Providence Health Care Renal Program hemodialysis unit.

Need to Know

1. Air embolism during dialysis is another cause of chest pain as well as other symptoms, particularly dyspnea.
2. Air embolism is a potentially fatal complication of hemodialysis that must be recognized and treated immediately to avoid catastrophic outcomes.
3. The severity of the symptoms depends on the amount of air injected, the rate of injection, the size of the bubbles and the point of entry.
4. It can lead to death unless quickly detected and treated.
5. Air embolism is rare in Hemodialysis patients, in part because of the presence of air detectors in hemodialysis machines.
6. Foam in the venous blood line should make one suspect should make one suspect that air has entered the dialysis system
7. Disconnection of connecting caps and/or blood lines can also lead to air embolism in patients being dialyzed with central venous catheters.
8. Causes of air embolus during hemodialysis include:
    - Disarmed or defective extracorporeal air detector.
    - Loose or open connections (central lines and needles).
    - Leak in the extracorporeal circuit.
    - Empty air-vented IV bottles/bags (e.g. albumin bottle) connected to the extracorporeal circuit.
    - If the water that is supplied to the dialysis machine is very cold, air dissolved in the water may exceed the de-aeration capacity of the delivery system resulting in air passing from the dialysate to the blood in the dialyzer.
    - Microemboli created by blood passing over a faulty area in the extracorporeal circuit.

Protocol

Assessment

Signs and symptoms may be dependent on the physical position of the patient at the time of the introduction of air.

For example:

- Upright position: air will travel to the cerebral venous system via the jugular vein without entering the heart.
- Supine position: air may enter the pulmonary circulation or impair cardiac functioning.
- Trendelenberg position: air may pass to the lower limbs causing patchy cyanosis

Signs and symptoms of air embolism may include:

- Sensation of air rushing into the circulation (e.g. hearing the “sound of a train” or “rushing air”)
- Arrhythmias
- Chest pain or tightness, dyspnea, shortness of breath, cough, cyanosis and visual disturbances
- Neurological deficits such as confusion, coma and hemiparesis
- Churning sound on auscultation of the heart
- Loss of consciousness, convulsions or death

Interventions:

1. Stop infusion of air immediately. Clamp the blood lines and stop the blood pump. Do NOT return the patient’s blood.
2. Place patient on the left side in a supine position, with the chest and head tilted downward. This position will trap the air in the apex of the right ventricle away from the pulmonary valve.
3. Cardiorespiratory support, administration of 100 percent oxygen by either mask or endotracheal tube, and attempted percutaneous aspiration of air from the ventricle maybe required.
4. Assess and monitor vital signs.
5. Notify physician or Nurse Practitioner.
6. If patient is unconscious initiate call Code Blue or 911 STAT.

Prevention of air embolus during hemodialysis:

1. Proper use of calibrated air detector equipment at all times during dialysis.
2. Visual inspection of the entire venous bloodline for the presence of air and micro bubbles before connecting to the patient.
3. Visual inspection of venous bloodline before overriding air detector alarm.
4. Ensure that all connections throughout the extracorporeal circuit are seated and secure.

5. When discontinuing dialysis, return patient's blood using saline and ensure that venous line is in the air detector and the air detector is armed. NEVER return the patient's blood using air.
6. During dialysis, if administration of saline is necessary, administer as a bolus rather than a constant infusion, unless an IV infusion pump is used.
7. Carefully monitor all infusions into the extracorporeal circuit.
8. Administer IV solutions in bags and avoid the use of glass air-vented bottles when possible.
9. Double clamp IV infusion lines when not in use.
10. Monitor the patient throughout treatment for the onset of signs and symptoms of treatment and equipment-related complications.
11. Ensure the alarm and machine safety checks are performed prior to commencing dialysis and during the dialysis treatment.
12. Ensure the patient, vascular access, blood lines and the dialysis machine are visible at all times during the dialysis treatment.
13. Never leave the patient unattended during the hemodialysis treatment.

Documentation

1. Document event including signs, symptoms and interventions on the hemodialysis log or interdisciplinary notes.
2. Document the physician's verbal orders on the physician's order sheet (as per hospital policy).

Patient and Family Education

Educate the patient regarding:

- The potential harm of air entering the extracorporeal circuit.
- The need to observe for any signs of air in the extracorporeal circuit during dialysis.
- The importance of ensuring that all connections on the extracorporeal circuit are secure.
- The importance of ensuring the nurse is able to visualize the patient, vascular access, blood lines and machine at all times during the treatment (e.g. do not cover access with blankets)
- Importance of informing the nurse for any machine alarms.

Related Documents

1. Hemodialysis: Patient Assessment Pre, Intra and Post Dialysis
2. NCS5434 - Hemodialysis: Cannulation of an Arteriovenous Fistula or Graft, procedure
3. NCS5148 – Hemodialysis: Initiating using a Central Venous Catheter (CVC) with and without TEGO Connectors, procedure
4. NCS5144 – Hemodialysis: Discontinuing using a Central Venous Catheter (CVC) with and without TEGO Connector, procedure

5. IDG1164 – Cardiac Arrest (Code Blue): Initiating, procedure for (SPH and MSJ)
6. Pharmacy policy –Telephone/Verbal orders
7. Medication Safety Huddle: Verbal and Telephone orders

References

1. Counts, C.S. (Eds.). (2008). *Core curriculum for nephrology nursing* (5th ed.). Pitman, NJ: Anthony J. Jannetti, Inc.
2. Holley, J.(Author), Berns, J.(Editor), Sheridan, A.(Editor) Retrieved on February 2018 from http://www.uptodate.com/contents/acute-complications-during-hemodialysis/print?search...
3. Molzahn, A. & Butera, E. (Eds.). (2006). *Contemporary nephrology nursing: Principles and practice* (2nd ed.). Pitman, NJ: Anthony J. Jannetti, Inc.

Approved/Reviewed/Revised:

NCS6338 Approved February 28 2005

Revised: June 12 2018