

## **Cardiac Shunts and Venting of IV Tubing to Reduce Air Embolism Risk:**

If a patient has a communication of the blood flow between the right and left side of the heart, any entry of intravenous air will pose a risk. Defects can be congenital or acquired. A Patent Foramen Ovale (PFO) or Atrial Septal Defect (ASD) is a communication between the right and left atria. A Ventricular Septal Defect is a communication between the right and left ventricle. Complex congenital cardiac anomalies can also include one or more communications.

Blood that travels through a communication within the heart (or shunt) will flow from the area of high pressure to low pressure. If heart pressures are normal this will usually be from left (oxygenated) to right (deoxygenated). Oxygenated blood will mix with deoxygenated blood on the right, and travel to the lung. This is a non-cyanotic defect.

If the right heart pressures become higher than the left (or the defect is very large), blood can flow from right to left. This can cause hypoxemia (or a cyanotic defect) as deoxygenated blood bypasses the lung and enters the left heart directly.

Right heart failure increases the risk for right to left heart shunting. Transient elevations in right heart or pulmonary artery pressures can cause intermittent shunting with desaturation or cyanosis. Examples of causes for intermittent right to left shunt include coughing, suctioning, breath holding or childbirth. In children with cyanotic cardiac defects, hypoxemia worsens with suckling or crying, whereas, crying will improve often improve oxygenation if the cyanosis is due to respiratory issues (e.g. pneumonia).

While shunting of desoxygenated blood with hypoxemia is one important problem for patients with an intracardiac shunt, the entry of air into the blood stream poses another.

If air enters the circulation and crosses directly to the left side of the heart, the air can travel to the brain (causing a stroke) or other organs/tissues (infarction). Coughing, suctioning or childbirth places the patient at increased risk.

### **HOW TO FILTER FOR AIR**

Patients who have a cardiac shunt should have air filters added to all IVs. This can be achieved as follows:

#### **AIR VENTING FOR NON-BLOOD PRODUCTS:**

- Use an infusion pump for the administration of IV fluid (to provide initial air detection/prevention) **plus** a air venting filter at the distal end of the IV tubing
- The air venting filter should be 0.2 – 1.2 micron (0.2 doubles as a particulate filter for drugs such as amiodarone or phenytoin).

- The inline air venting filter should be at the distal end of the IV tubing. Whenever possible, *there should be no injection port between the filter and the patient's IV access.*
- **Propofol require a .5 – 1.2 micron filter to prevent plugging.**

### **Priming and Care of the Vent Filter**

Prime the tubing ***without inverting the filter.*** Keep the distal end of the filter pointing down (the air vent is proximal – air needs to rise to escape).

Once the filter is wet, air will no longer be able to enter the patient's site.

Keep the filter at or below the level of the heart.

Change the filters every 24 hours to prevent plugging.

### **Alternatives if Air Vent is not Available**

- TPN sets with filters can be used if an inline filter is not available. Most will be 1.2 microns which is acceptable for both air and lipids containing solutions (including propofol)
- The Level 1 Hotline fluid warmer circuit can be used **with an L 10 gas vent added to the circuit** (HMMS Item #55367).



**Figure 1:** L 10 Gas Vent for use with Level 1 Hotline

Note: the L-10 inline vent is identified as containing Latex, however, the latex is only on the outside of the device and does not come in contact with the fluid pathway.

### **ADMINISTRATION OF BLOOD PRODUCTS:**

Blood tubing is required for all blood products. Standard blood tubing filters DO NOT eliminate air

- The Level 1 rapid infusor has a built in air venting filter
- For blood products that can be administered at a normal rate, administer using the Level 1 Hotline fluid warmer.  
Use standard blood filter tubing (for blood product filtering) with a Level 1 – LP 10 inline air vent added (for evacuation of air). The blood filter must be connected proximal to (above) the air vent.
- For rapid administration of blood products, the Level 1 Rapid Infuser has a blood and air vent filter included.

BM: Updated December 24, 2020