
PRODUCT UPDATE

Clinical Center Standardization Committee



March 2003 (1)

ALARIS MEDICAL SYSTEMS® MEDLEY™ INFUSION PUMP UPDATE NUISANCE AIR-IN-LINE ALARM “BUBBLE TROUBLE” EXPLANATIONS AND SOLUTION TIPS

There are several contributors to the nuisance air-in-line alarms (false positive air-in-line alert) or “BUBBLE TROUBLE” associated with IV therapy.

The primary “BUBBLE TROUBLE” contributors are: outgassing; set priming; silicone & air ingress; container venting; medications; Air-in-Line detector.

This document provides an explanation about each contributor and provides some practical solution tips to reduce or eliminate “BUBBLE TROUBLE.”

OUTGASSING

This phenomenon is the formation of micro-bubbles in solutions housed in plastic containers. Air dissolves in water-based solutions, and the air trapped in, or passing through the gas-permeable membrane of the plastic container can lead to the formation of champagne size micro-bubbles. The amount of gas that can be dissolved increases as the temperature of the solution decreases and the barometric pressure increases.

Refrigerated solutions dissolve more air than one kept at room temperature.

Solution Tips

- Allow refrigerated solutions to achieve room temperature prior to use. Warming the solution above room temperature for a few hours before hanging, allows the dissolved air to form small bubbles that will rise to the top or the bag.
- When warming the solution is not practical, slapping the solution container bag forces the small bubbles to rise to the top.

SET PRIMING

Priming the IV set quickly can form air pockets within cavities of components throughout the fluid pathway of an IV set such as the “Y” injection ports or pressure sensing devices. After a brief period of time the trapped air is released out of these cavities and into the fluid pathway can form a column or columns of air.

Solution Tip

Prime the IV set slowly while inverting and tapping the elements that can trap air. This will eliminate the air column(s) from forming.

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SILICONE & AIR INGRESS

Silicone elements within the IV fluid pathway, such as a silicone tubing segment used in conjunction with the pumping mechanism of an instrument to displace fluid, may permeate air through the silicone tubing wall. This ingress of air only occurs when a negative pressure is developed in the fluid pathway below the silicone element, and that this negative pressure remains relatively constant for several hours. Under this condition, micro-bubbles in the silicone fluid pathway begin to form and eventually coalesce to form a column of air.

Several factors influence the length of time before this air column is formed. These include: rate of delivery (at 1 ml/hr the interval before a air column is formed can be between 6 to 8 hours); air-in-line detection level set in the instrument; height of the instrument relative to the patient.

Solution Tip

Lower the instrument to the level, or slightly below the level of the patient. This will maintain a positive pressure in the fluid pathway of the set, and inhibit air ingress through silicone elements.

CONTAINER VENTING

Sealed fluid containers such as bottles and burettes that have their fluid intake clamped off, require venting of air in order to displace fluid. The fluid displaced by the infusion pump creates a vacuum in these containers if they are not vented. This can lead to a train of bubbles or columns of air streaming down the tubing. This is caused because no air is available to replace the fluid being drawn from the container, and what air exists in the container is expanded (2 times or more). This expansion forces the fluid in the drip chamber of the set to empty which results in air ingress into the tubing.

Solution Tip

Be sure to check that the venting tab on the set is open, whether it be the venting tab on the drip chamber or the venting pigtail on the burette.

MEDICATIONS

Some fluid solutions such as blood products, including Albumin, tend to froth or foam when delivered at high rates. This frothing can be caused by the agitation created by the instrument's pumping mechanism. Once again, this frothing can coalesce to form a column of air leading to an air-in-line alarm. Additionally, Lipids solutions tend to separate when forced to travel through an arduous path such as a tight "S" looping of the IV tubing as it enters the instrument. This fluid separation can form a column of air that can again lead to an air-in-line alarm.

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Solution Tips

- For blood product delivery, filling the drip chamber of the IV set maintains a contiguous fluid pathway that prevents frothing of the solution since there is no air chamber for frothing to form.
- For Lipid solutions, maintaining an in-line pathway of the IV tubing—from the container to the instrument—prevents fluid separations.

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AIR-IN-LINE DETECTOR

The air-in-line detectors are piezoelectric devices that rely on good surface contact with the tubing in order to reliably detect the presents of air in the fluid pathway. If the contact surface of this device is heavily dirty, such as a film of dried solution from a fluid spill, the result may be bubble trouble—a false positive or nuisance air-in-line alarm.

Solution Tip

Periodically clean the surfaces of the air-in-line detector assembly.

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GENERAL COMMENTS

IGG—Immune Gamma Globulin (IGG), and other protein solutions like Albumin, often have detergents, like maltose, to keep the protein solubilized. Agitation by some infusion pump mechanisms may cause foaming of this solution resulting in small bubbles to coalesce at the air-in-line detector, eventually causing a nuisance air-in-line alarm. Some institutions have found that by orienting the pump on its side allows these small bubbles to be suspended, and pass through the air-in-line detector without coalescing at the air-in-line detector, hence eliminating the bubble trouble—a false positive or nuisance air-in-line alarm..

Blood Delivery—High delivery rates (greater than 200 ml/hr) can cause foaming of blood products, due to the agitation cause by some infusion pump mechanisms. As demonstrated in auto-transfusion applications, keeping the vent on the set tightly closed and allowing the set drip chamber to be completely filled, minimizes this foaming process.

Cyclosporine—Use the ALARIS low sorbing set. Over-fill the drip chamber to reduce the air trapped as the drop splashes into the drip chamber. Lower the pump on the pole as close to the level of the patient's IV site as possible. This will reduce the coalescing of air at the air sensor over time with viscous solutions. Keep the IV tubing in a straight line above the pump. Bends in the tubing can collect out gassed bubbles, which then collect, and migrate down to the air detector over time.

Interlink Lever Lock Cannula—A blunted tip may impede flow. Replace the cannula.