Equipment modification to prevent air embolism with LEVEL 1® H-500 fluid warmer

To the Editor:

We wish to report our modifications to a LEVEL 1® model H-500 fluid warmer with a D-100 disposable set (Level 1 Technologies Inc., Rockland, MA). We modified this warmer after a large air embolus had been delivered through it during a liver transplant. The LEVEL 1® model H-500 fluid warmer may be more effective than other warmers during massive transfusions,[1] but observation alone[2] may be inadequate to prevent air emboli.[3] Although removal of air from *iv* bags connected to this fluid warmer is required,[4] compromises may occur in clinical practice, and human error is always possible. Air emboli may also occur if air enters a fluid bag by traversing the opposite limb of the Y-tubing when fluid bags are changed, later entering the patient during pressurization.[5] Although air should escape through the filter/air eliminator assembly and leave the fluid path, we noticed that this membrane may sometimes clog in less than three hours, even if the flow of blood through the assembly has not slowed noticeably. (Figures 1–3).

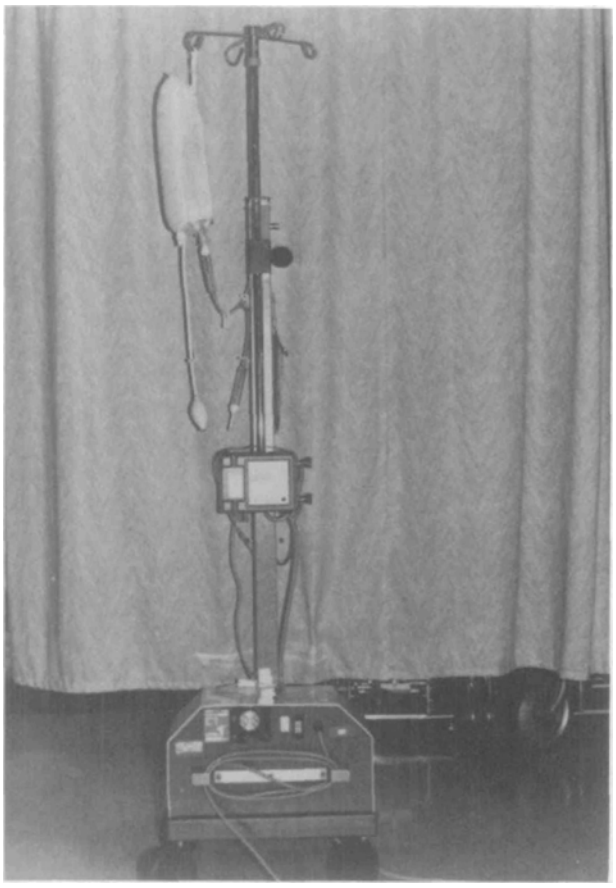

FIGURE 1 The H-500 fluid warmer is pictured with the air detector attached to the filter/air eliminator. The tubing runs through the line clamp before entering the patient.

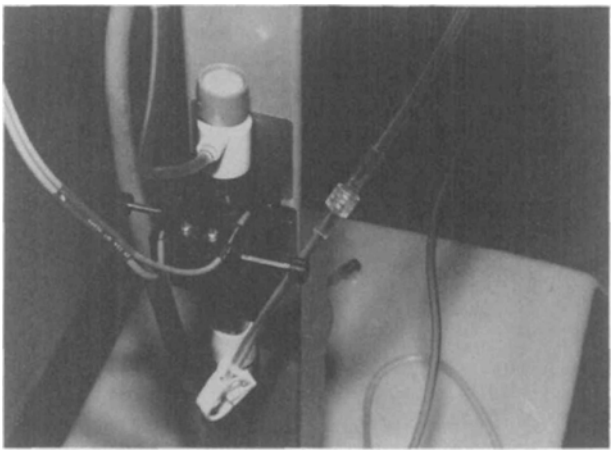

FIGURE 2 The ultrasonic air detector must be located above the level of the filter element of the filter/air eliminator, so that no solid objects reflect the ultrasound. To prevent the weight of the sensor from pulling the filter/air eliminator out of its housing, a strap or tape can secure the filter/air eliminator to the vertical support.

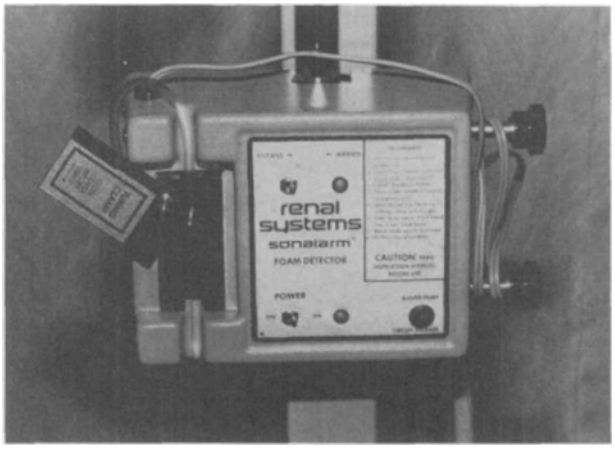

FIGURE 3 The large bore *iv* tubing passes; through the tubing clamp, shown here in closed position. The cover must be closed during actual use.

We attached the SONALARM™ Foam Detector model RS-3220A (Renal Systems, Minneapolis MN) to the LEVEL 1® model H-500 fluid warmer. Upon sensing air or foam, the SONALARM™ RS-3220A delivers visible and audible alarms and clamps the *iv* line to stop the flow of fluid. In this installation, we removed a

switched power cord to prevent its unintentional use with other equipment. The SONALARM™ Foam Detector is not specifically recommended by its manufacturer for this installation on the LEVEL 1® model H-500 fluid warmer. In two years of clinical use, we have found that the air detector has been triggered when air was present but not visible in the filter assembly. Air eliminator/filter replacement resulted in normal function in each case.

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