Air in Patient IV Lines – Fluid Warmers, Syringes and Other Clinical Interventions that Increase Air Burden for Patients

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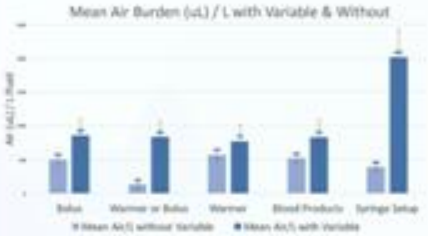
Definitions

Air in intravenous (IV) lines can be harmful, even in small amounts. The risk is greatly magnified in pediatric patients with congenital heart disease. This patient population is at particular risk during surgery, when standard IV line air filters are not feasible for the administration of blood products or medications. With an understanding of the events that trigger air entry, clinicians can mitigate the air burden and stop preventable air from reaching their patients. Several devices are now on the market that purport to effectively remove air from IV lines. One is the ClearLine IV from ClearLine MD (Woburn, MA). The ClearLine IV consists of the control unit and the disposable cartridge. Air is detected in the IV line by a software-controlled ultrasound sensing technology. When air is detected, the flow is diverted to a collection chamber. When air is no longer detected, flow to the patient is resumed. The device purports to remove air bubbles as small as 25 microliters at flow rates of up to 400 ml/minute. The primary objective is to identify the triggers of air entrainment due to IV manipulations and understand its delivery in a typical clinical setting.

Methods

A multicenter, prospective observational study was conducted at four different academic institutions. After informed consent was obtained, the ClearLine IV was inserted into the IV line of adult and pediatric surgical patients undergoing the procedures. Practitioners conducted the anesthetic in their normal fashion. IV fluid was administered at a constant flow rate or via boluses given over 30-60 seconds. The start of the IV and the commencement of the ClearLine IV was noted. Blood warmers were used at the discretion of the practitioners. Fluid administration was recorded by noting volume and duration of administration. At the end of the case, data was collected from the device on the frequency, duration and amount of air captured along with clinical manipulations of the IV line.

Results



Characteristics	Percentages and Means
Race	77.3% White 22.7% Other
Height[Min, Max]	112.7cm[68cm,185cm]
Weight[Min, Max]	53.2kg[5kg,128.3kg]
Age[Min, Max]	28.5[3 months, 87yrs]

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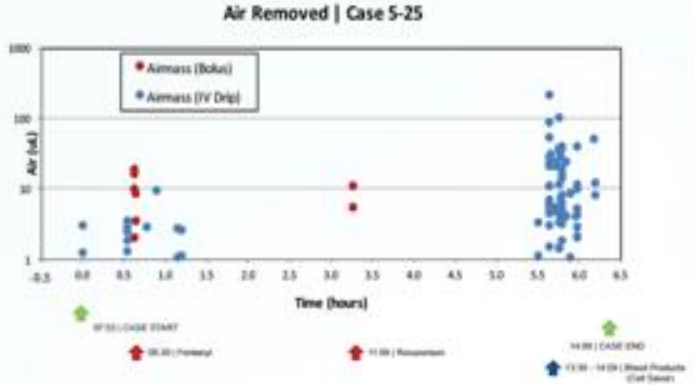

Conclusions

This study demonstrates there are specific clinical manipulations causing air entrainment in patient IV lines. Those events are the use of fluid warmers, blood product delivery, bolus injections, and the use of syringes; the results demonstrate an elevated risk of air entrainment in the IV line for these events. Currently, pumps often alarm when air is detected, leading to manual intervention. The efficacy of this method has been questioned. A product called ClearLine IV automatically detects, captures and eliminates air from IV lines reducing the air burden to the patient.

References

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