

## CURRENT COMMENT

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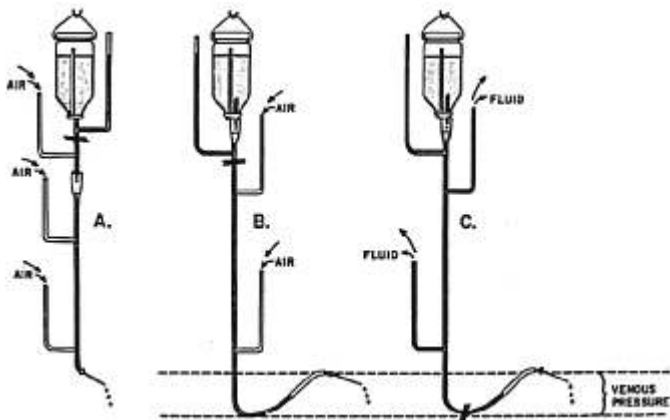
### TECHNIQUES

#### Prevention of Air Embolism from Intravenous Sets

Dr. Sanford Cobb of Miami, Florida, remarks that the plastic tubing of disposable intravenous sets is not immune to defects in manufacture, nor to damage. The possibility of slow but massive air embolism via small cracks or holes in intravenous tubing is created by physicians who place the rate-controlling clamp of the infusion set at the level of their own eyes. This danger, furthermore, is neither emphasized nor mentioned in most textbooks studied by the anesthesiologist-in-training.

MacIntosh (MacIntosh, R., Mushin, W. W., and Epstein, H. G.: *Physics for the Anaesthetist*, ed. 2, Charles C Thomas, Publisher, 1953, pp. 188-191) has illustrated the air embolism hazard for sets incorporating a length of tubing between drip chamber and flask, when the clamp may be placed above the chamber. However, this practice (in which the contents of the chamber and the tubing are under negative pressure) has been deemed acceptable (Adriani, J.: *Techniques and Procedures of Anesthesia*, ed. 2, Charles C Thomas, Publisher, 1956, p. 266). Although MacIntosh mentioned that the clamp should be placed low on the tubing, no data were offered for the modern type of set where the drip chamber is attached to the flask, and the clamp perforce is secured below the chamber.

The following experiment was performed to demonstrate that negative pressure exists within *any* intravenous infusion set whenever the rate-control clamp is placed higher than the level of the venous pressure. The experimental apparatus is illustrated and consisted of an intravenous set with open-top manometers connected to it at different levels.



The air embolism hazard inherent in high clamp placement on intravenous sets. Details in text.

In section (A) of the figure, the experiment of MacIntosh is verified: a length of tubing is interposed between drip chamber and flask, and a clamp affixed there. Pressure within tubing and chamber is negative everywhere below the clamp, and air enters through all three manometers below the clamp (which correspond to "holes" in the intravenous tubing). Only above the clamp is the pressure positive.

Sections (B) and (C) of the illustration consider the modern disposable intravenous set, wherein the drip chamber plugs directly into the solution flask. In (B), the clamp is placed just below the chamber. Negative pressure is present within the tube from the clamp to a short distance above the needle (the latter distance being equivalent to the venous pressure). Air enters through all manometers below the clamp, even though the clamp is below the drip chamber. The presence of a small hole or patent crack anywhere in this section of tubing will cause the patient to be infused with air.

Section (C) illustrates the only safe way to apply the flow-controlling clamp: the clamp must be at or below the level of the needle. Pressure within the system is now positive everywhere. A crack or pinhole anywhere in the set will result in egress of fluid rather than ingress of air.

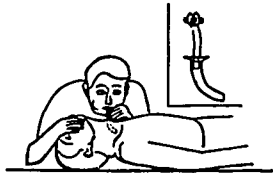
The hazard of air embolism from high clamp placement exists even when plastic blood bags are used. All that is needed to produce air embolism is a hole in the tubing below the clamp, no matter what type of infusion set is used.

### Mouth-to-Tracheotomy Tube Resuscitation

Drs. Peter Safar and Chung J. Park of Baltimore, Maryland, believe that reoxygenation of apneic asphyxiated patients in the absence of equipment can be performed most rapidly by intermittent inflation of the lungs with expired air. Vital seconds should not be wasted searching for equipment. Not infrequently respiratory resuscitation must be performed on tracheotomized patients in hospitals. In such emergencies, in the past, nurses and physicians at the Baltimore City Hospitals have inflated the lungs of tracheotomized patients by one of the following two methods: (1) Direct mouth-to-mouth breathing while the tracheotomy cannula was occluded with one finger. (2) Mouth-to-tracheotomy tube breathing by placing the mouth over the anterior aspect of the patient's extended neck including the tracheotomy opening.

Method (1) is difficult to perform because both hands are necessary to support the patient's mandible. It may also fail if the tracheotomy was performed to by-pass upper airway obstruction. Method (2) proved not to be very aesthetic, particularly in the presence of secretions in the trachea or when there was blood or pus at the tracheotomy tube or the surrounding skin.

They recommend the method illustrated. The inner cannula of the regular tracheotomy tube is withdrawn partially so as to leave only its tip in the outer cannula. The inner cannula turned to the side for easier accessibility serves as the operator's mouth-piece. The patient's head is tilted backward, preferably by elevating the shoulders with



Recommended method for resuscitation in tracheotomized patients.