

Anesthesiology
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Air Entrainment during Cardiopulmonary Bypass Surgery

To the Editor:—Accidental needlestick exposure remains a significant source of potential risk for the spread of blood-borne disease. While abandoning the practice of "recapping" used needles would decrease the risks involved, an injection system that totally avoids the direct use of needles when dealing with patients seems desirable. Quest Medical, Inc. (product code 9222) and Burrion Medical, Inc. (product code ET-06V) have introduced extension sets incorporating multiple injection sites having normally "closed" backcheck valves. (fig. 1, B and C, respectively.) In addition, Quest Medical provides an extension set (product code 9113) the valves of which require little if any pressure to open and have been frequently used with infusion pumps that might otherwise alarm when required to generate enough force to open normally closed valves (approximately 1.5 psi for product 9222) (fig. 1, A)

This report describes two patients undergoing cardiopulmonary bypass (CPB) for myocardial revascularization in whom air entrainment occurred through an injection port of such an extension set. In each patient, the right internal jugular vein was cannulated with an 8.5-Fr introducer to permit placement of a pulmonary artery catheter. In each patient, double venous return cannulae were used. Infusion of intravenous fluids was discontinued during CPB. During the procedure on the first patient, air entrainment was noted in the superior vena caval venous return tubing, which was unresponsive to usual methods of correcting for entrainment—*e.g.*, manipulating the tubing and filling the pericardium with saline. While assuring ourselves that the introducer catheter itself did not become disconnected, we observed air in the sideport and Quest Medical extension set, originating at the site of an uncapped injection port. This was promptly capped off with no further air entrainment and no adverse patient consequence. Proper use of such extension sets was reviewed within the department and the manufacturer notified of our experience.

The second occurrence took place 1 week later. A Burrion Medical extension set was used on the introducer sideport, and when not in use, the injection ports were promptly covered with the caps provided with the set. Air entrainment was again noted in the superior vena caval return tubing, to a degree greater than noted in the previous patient, and nearly enough to cause an "air lock" in the venous return tubing. Further inspection revealed that the caps over the injection ports had failed to provide an occlusive seal and had allowed the entrainment of air. Prompt recognition and intervention prevented any patient sequelae. A representative of Burrion Medical was made aware of the potential risk given the above circumstances.

Although the use of a single venous return cannula has become standard for most adult applications at our institution, the use of separate vena caval return cannulae is necessitated from time to time, *e.g.*, for mitral valve replacement and for retrograde, coronary sinus cardioplegia. The use of two venous cannulas may enhance gravitational venous drainage as well. The scenario of very low or negative central

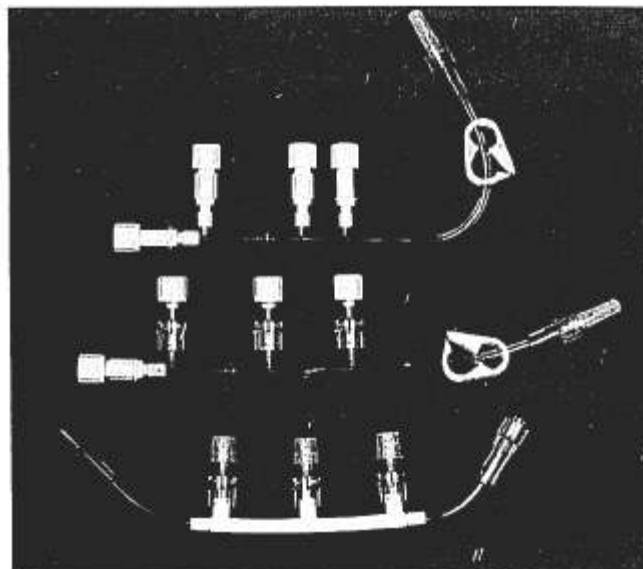


FIG. 1. Extension sets that may allow air entrainment when not properly configured. A: Quest Medical extension set with backcheck valves, code 9113. B: Quest Medical extension set with backcheck valves, code 9222. C: Burrion Medical extension set, code ET-06V.

venous pressure infusion rate associated with cardiopulmonary bypass and low intravenous fluid combined to produce a set of circumstances favoring the entrainment of air at an otherwise competent injection port. The purpose of this report is to underscore the need for occlusive caps when these injection ports are not in use, particularly when circumstances such as these would favor air entry. The caps currently provided by Burrion for their device failed to produce a tight seal and must be replaced with appropriate caps if the product is to be used for this application.

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In Reply:—As Quinn states, when not in use, the valves must be capped with a dead-end cap, as noted on the directions. Quinn states, "The injection ports were promptly covered with the caps provided with the set." However, the "caps provided with the set" are vented

touch-contamination protectors—not dead-end caps. Vented caps are placed on the valves during packaging as touch-contamination protectors and allow ethylene oxide gas through the set during sterilization.

The product to which Quinn refers is not a standard catalog item.