

rat (Strunin *et al.* accurately listed some of them<sup>1</sup>). I believe that as research with the model matures, investigators will find the rat model instrumental in discovering the link between anesthetic effects and hepatotoxicity. Furthermore, the mechanisms of hepatic damage in the rat indeed may be similar to those in at least one form of human postoperative hepatic dysfunction. Therefore, I cannot agree that the time for the rat's retirement has come.

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#### Safety Check for the CPRAM Circuit

*To the Editor:*—In the October 1982 issue of *ANESTHESIOLOGY*, KHI Anesthesia and Resuscitation (Frazer, Pennsylvania) advertises its coaxial Mapleson D circuit, the CPRAM™ (Controlled Partial Rebreathing Anesthesia Method) Breathing System. It differs from the Bain circuit, another coaxial circuit, by having two sideholes at the patient end of the inner (fresh gas) hose (fig. 1). The manufacturer claims that this results in "vortex dynamics," which provides better humidification of fresh gases and efficient removal of carbon dioxide. We believe that the design of this circuit creates a possible hazard for the patient. Accordingly, we have devised a technique to protect against this risk.

If the inner hose within a coaxial Mapleson D circuit is partially or completely fractured or disconnected, fresh gas can enter the circuit in a proximal portion of the outer tube rather than at the patient connection. This increases dead space and may result in hypercapnia and possibly hypoxemia. Malfunctioning of the fresh gas hose occurred with early models of the Bain circuit,<sup>1</sup> leading Pethick<sup>2</sup> to suggest a way to detect proximal disconnection of the inner tube. Oxygen is flushed through the circuit with the patient end of the circuit open. If the inner hose

is intact, the high flow through the inner hose will create a Venturi effect, drawing gas from the outer hose and collapsing the reservoir bag. In contrast, if the inner hose is disconnected or has a fracture, gas will escape to the outer hose and inflate the reservoir bag.

Unfortunately, when this test is performed with the

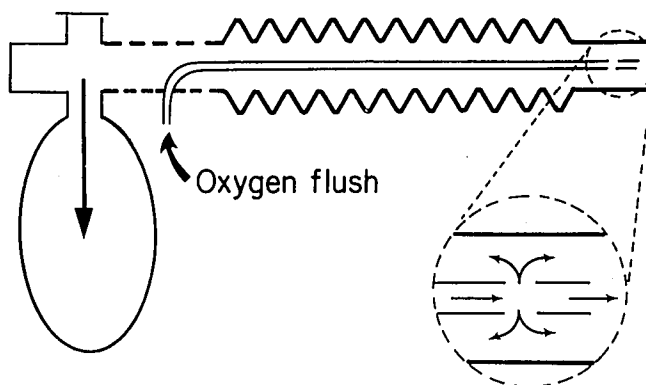


FIG. 1. When the CPRAM™ circuit is flushed with high-flow oxygen, gas exits through the side holes and the reservoir bag always fills, regardless of the integrity of the inner hose.

CPRAM™ circuit, gas exits through the sideholes and the reservoir bag always fills. Although the manufacturer claims that the corrugated design of the inner hose makes it less likely to fracture, the user cannot determine whether there is a problem. Thus, a potential hazard exists.

We learned that we could apply Pethick's maneuver to this new circuit by occluding the sideholes but not the endholes. We occluded the sideholes by placing a 1.5-cm segment of a 6.5-mm endotracheal tube over the patient end of the inner hose. We recommend that the manufacturer provide a similar device for all CPRAM™ circuits so that Pethick's test can be used to detect a possible fracture or disconnection in the inner hose.

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*In reply:*—Drs. Robinson and Fisher indeed have pointed out a difference between the CPRAM™ and the Bain circuits. The Pethick test will not produce a collapse of the reservoir bag with the CPRAM™ circuit alone. To produce a positive Pethick test with the CPRAM™ circuit insert the mask elbow, supplied with each circuit and flush oxygen through the circuit. A positive Pethick test (collapse of reservoir bag) will occur. A standard 9 mm endotracheal tube connector, inserted in the patient end of the CPRAM™ circuit, in place of the mask elbow, also will produce a positive Pethick test.

A positive Pethick test cannot be produced if the inner tube of the CPRAM™ circuit is disconnected, punctured, or fractured, thus producing a leak. Because a mask elbow is supplied with each CPRAM™ Circuit, it is felt the method as outlined above is superior to supplying . . . "a 1.5-cm segment of a 6.5-mm endotracheal tube" as Robinson and Fisher suggest. It could be left inadvertently on the inner tube, or worse, could dislodge and be forced into the patient's airway.

The Pethick test generally is considered an important test for checking the integrity of the inner tube of co-axial circuits; it is our experience that it is not entirely

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foolproof. Published correspondence indicates that, under certain circumstances, the test may not detect inner tube disruption.<sup>1</sup> In our opinion, the Pethick test does not eliminate the need for prudent inspection of any circuit prior to use.

We must point out, in the interest of accuracy, the KHI Inc. advertisement as published in the October 1982 issue of ANESTHESIOLOGY reads as follows: "Corrugated inner tubing decreases possibility of kinking." We do not claim, as Robinson and Fisher state, ". . . inner hose makes it less likely to fracture."

We thank Drs. Robinson and Fisher for their interest in our CPRAM™ Breathing System.

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### Use of Microcomputers for Teaching

*To the Editor:*—I would like to share one way to use microcomputers as a teaching tool. Electronic spread sheets, now widely used in the business world, can be adapted easily to clinical anesthesia teaching. A simple example is the use of the copper kettle vaporizer.<sup>1</sup> A commonly used electronic spread sheet, Visicalc® (Visi-corp, Cambridge, Massachusetts), has been set up to teach

the use of a copper kettle vaporizer (fig. 1). All the variables such as vapor pressure, atmospheric pressure, flow of gas through the vaporizer, and total gas flow are set up in the formula. The "Replicate Command" sets up the vertical columns, and "look up" sets the value in the appropriate positions. The program user then can type in a change in any selected variable, for example, flow