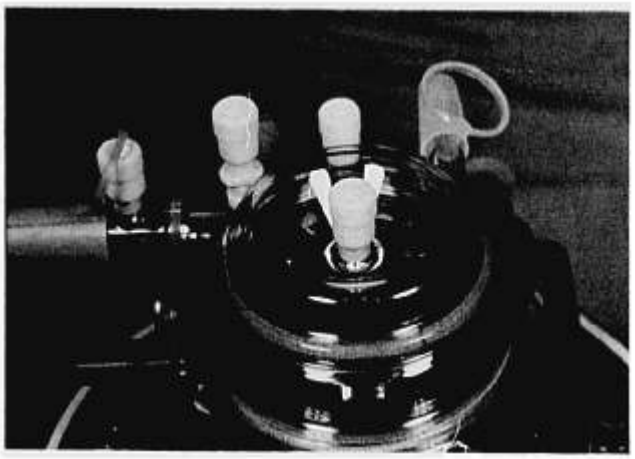

FIG. 1. Top of Bentley-10 Oxygenator.

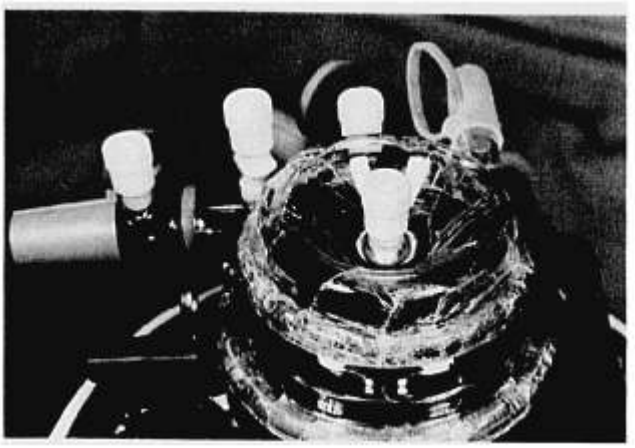

FIG. 2. Same Bentley-10 Oxygenator as in figure 1 after 1 ml of isoflurane has been dropped on it.

distribution of this publication and the absence of any warning by the manufacturer, we believe that a more widespread alarm should be sounded.

We have since changed the location of our pump vaporizer and prohibited its filling while the pump is set up. We strongly recommend that those using isoflurane and halothane take steps to insure that the liquid form of these agents does not come into contact with materials made of polycarbonate.

In summary, polycarbonate plastic reacts adversely to liquid isoflurane by cracking and fragmenting. Since cardiac bypass equipment utilizes polycarbonate plastic for some items (especially the oxygenator), there is danger in exposing such devices to liquid isoflurane. Liquid halothane can effect the plastic to a lesser degree, causing softening, while liquid enflurane has no effect.

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## Near Catastrophic Oxygenator Failure

*To the Editor:*—We wish to point out that spillage of liquid anesthetic agents can dissolve the plastic structure of membrane oxygenators, leading to potentially catastrophic interruption of cardiopulmonary bypass (CPB).

During a recent cardiac surgical procedure at Temple University Hospital, while the patient was on CPB, the perfusionist started to fill the Fluotec Mark 2 vaporizer in the CPB system with isoflurane. A few drops were spilled onto the Shiley M-2000 membrane oxygenator mounted directly below the vaporizer. Seconds afterward, blood was pouring out of the arterial outlet port onto the floor. The arterial outlet port had almost broken off of the main frame of the oxygenator. A large crack extended the length of the oxygenator (fig. 1). The heart-lung machine was immediately turned off and the arterial line clamped.

Fortunately, the patient's core temperature was 34° C and the heart rate was still 90. Mean arterial pressure (MAP) fell to 20 mmHg for approximately 1.5 min. The perfusionists were able to manually squeeze the blood in the venous reservoir back into the patient. After this transfusion of 0.5 liters of blood, the MAP rose to 50 mmHg. Resuscitation consisting of crystalloid, one unit of packed red blood cells, and dopamine and neosynephrine infusions kept the MAP at 60–70 mmHg for 15 min while the perfusionists changed the oxygenator.

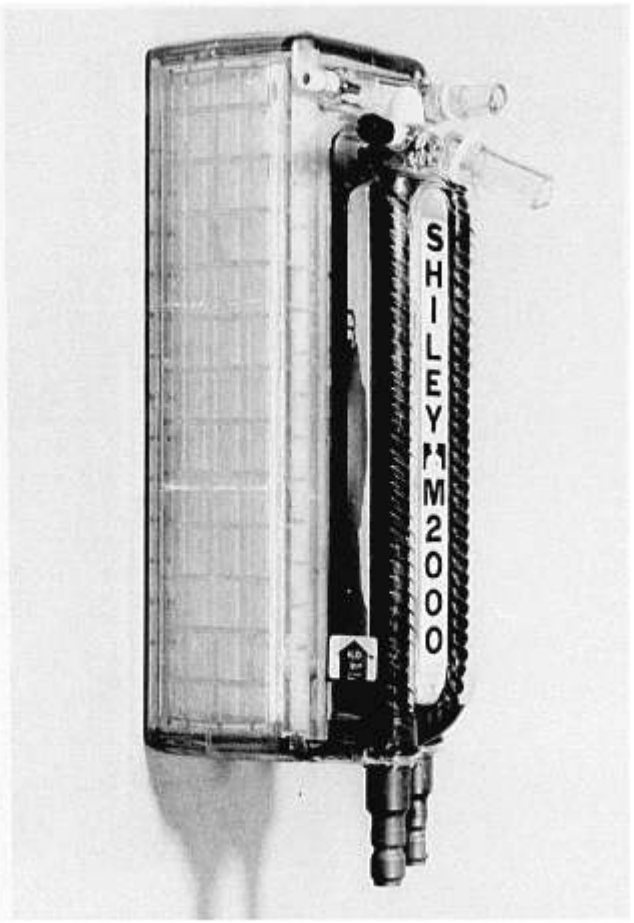


FIG. 1. Arterial outlet port, top, is partially severed from the oxygenator body. A crack extends vertically from the arterial outlet port left of the manufacturer's nameplate to the water inlet and outlet ports at the base.

Total CPB time was 72 min. The patient did not require inotropic support post-bypass. Postoperatively, the patient was hemodynamically stable and neurologically intact.

After this incident, we discovered that enflurane and halothane also crack the polycarbonate housing of Maxima Hollow Fiber, Scimed II, and Shiley M-2000 oxygenators. Arterial filters and cardiotomy reservoirs generally have polycarbonate components as well.

This accident graphically illustrates the fact that ethers, hydrocarbons, and esters act as solvents on plastics.[1] In our institution, the vaporizer was moved away from polycarbonate components. Warning labels should be given serious consideration.

This surgical procedure and anesthetic was performed at Temple University Hospital in 1986. This letter has not been presented at any meeting.

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## The Value for Organ-related Clearance of Atracurium: An Over-calculation

*To the Editor:*—I was a little surprised to read the recent publication by Fisher *et al.*[1] which concluded that more than half of a dose of atracurium was cleared from the body by organ-related clearance. Atracurium, as a molecule, is cleared from the body mainly by destruction of the parent molecule within its distribution volume. The logic for the conclusions in the abovementioned paper I find a little confusing.

Clearance is determined by multiplying the rate constant for elimination by the volume in which that clearance occurs. The authors have derived non-organ clearance by multiplying the rate constant of atracurium obtained *in vitro* by its steady-state distribution volume ($V_{ss}$), giving a mean clearance of only 40% of the total clearance. For total clearance, I assume they divided the dose by the area—under the curve for the plasma decay, as this agrees with all previous data published. The authors produce an *in vitro* half-life of 31 min, longer than previously published results of 21 min[2] and 25 min.[3] The distribution volume ($V_{ss}$) reported is very surprising, as steady state did not occur in their experiments, and elimination from both compartments means that the microkinetic parameters $K_{12}$, $K_{21}$, and $K_{20}$ are impossible to derive from their model. Their value for distribution volume for