Yet Another Machine Fault

To the Editor—While intraoperative complications of anesthesia are often the result of error in judgment, others are solely the result of equipment failure which may or may not be detected and corrected in a timely manner. Within the category of equipment failure, problems may be attributed to factors of design or quality control, the misuse (or abuse) of equipment, or to neglect. We wish to share with readers an incident involving a Dupaco Model 75000® anesthesia machine which suggests a potential hazard specific to that model.

REPORT OF A CASE

A 52-year-old man was being prepared for non-elective coronary artery bypass graft using high-dose fentanyl—relaxant—O₂ technique. After a routine check of the anesthetic machine, anesthesia was induced uneventfully and the patient was mechanically ventilated with a ventilator operated by piped O₂ at 50 lb/in². Shortly thereafter, it was noticed that the O₂ flowmeter of the machine had dropped from 5 l/min to zero flow, and it was verified that there was no output at the fresh gas output port. There was no signal from the failsafe alarm to indicate an O₂ supply failure. The ventilator continued operating, confirming the presence of adequate O₂ pressure. After quickly checking the competence of the machine gas connections, the dials indicated adequate gas pressure, and the machine’s backup E cylinders of O₂ were opened in order to circumvent any possible obstruction within the primary gas lines of the machine. The machine remained inoperative. Throughout this period, which lasted about 2–3 min, the patient continued to receive adequate ventilation with 100% O₂ that remained in the breathing circuit-ventilator assembly which essentially functioned as a closed system. A second anesthesia machine was quickly brought in and connected, and the surgery proceeded without further incident and without any clinical sequela.

On later examination it was found that, while all systems in the unit resumed normal function, the O₂ flush valve was inordinately slow to return to its normal position from the depressed “flush” position. Closer examination and disassembly confirmed that the spring-loaded spool-and-shaft assembly within the flush valve had gradually become more sluggish in returning to its normal position, such that the spring was able to push the spool out of the flush mode but not fully back to the normal position which allows supply to the flow tubes and vaporizers. There is a 4- to 5-mm interval of shaft travel in which the supply O₂ is closed to both the flush line and to the flow tubes (see fig. 1). It would appear that ordinary aging and hardening of the lubricant and of the two seals around the spool increased the resistance to its travel. Simple cleaning and relubrication of the components corrected the problem. This incident illustrates a case of equipment failure due to a minor misgiving in design coupled with inadequate preventive maintenance. While all our machines are serviced every four months by qualified service personnel under contract, an increasingly reluctant flush valve may not be obvious to everyone. Users of this model of machine may be advised to check the flush valve with particular care. The incident further reminds us of the value of a preoperative machine check performed meticulously before every anesthetic administration.

![Diagram of the oxygen flush valve assembly](image_url)

**Fig. 1.** Oxygen flush valve assembly showing path of gas (shaded area). Normal position shows the path of O₂ from inlet to vaporizer selector valve and thence to flow tubes. Flush position (knob depressed) shows the diversion of O₂ via the flush port.
Manufacturer's Comment

I do not agree with the statement that this “incident involving a Dupaco Model 75000® anesthesia machine . . . suggests a potential hazard specific to that model.” As reported in the letter, aging and hardening of the lubricant and the two seals around the spool increased the resistance to its travel. After this problem was discovered by the hospital, an authorized Dupaco dealer was called in to evaluate the situation, and it was determined (as was indicated in the letter) that the problem could have been avoided by implementing a more extensive preventive maintenance program. Simple cleaning and re-lubrication of the components corrected the problem.

ECRI has developed a preoperative machine checkout procedure that is available from ECRI in the form of a card which can be attached to each anesthesia machine. It is important that when servicing these machines it is not only necessary to insure that the flush feature is activated properly, but that the valve returns freely, restoring the pre-set flows through the flow tubes.

On apparatus manufactured prior to 1975, the flush valve incorporated a “twist-to-lock-on” feature. This feature was removed to comply with the ANSI Z79.8, 1979 standards. We recommend that the small cross pin in the shaft be removed to eliminate this feature. This is best accomplished at the time of servicing the valve. (It should be mentioned that the ANSI standard does permit a locking type flush valve, “if specially requested by the users.” The Dupaco flush valve does comply with this standard.)

We find it difficult to agree with the inference of this letter that the Dupaco Model 75000 anesthesia machine’s design contains this potential hazard. What we do agree with is the suggestion that following more specific service recommendations is in order: 1) A routine preventive maintenance program be initiated and followed for every anesthesia machine in use. 2) A preoperative machine check must be performed before every anesthetic administration.

JOSEPH G. ROSANO
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Technique is the Critical Variable

To the Editor:—Dr. Naulty and colleagues reported an incidence of air embolism of 47% during insertion of epidural catheters in 17 healthy women for analgesia for labor and delivery. 1 Although they did not evaluate methods for decreasing this incidence, they proposed several actions that might be taken to avoid the possibility of air embolism, including hydration, performance of the epidural in the lateral position, and per-