Transposition of Rotameter Tubes

To the Editor— I wish to draw attention to yet another mechanical failure which resulted in the delivery of a hypoxic anesthetic mixture to two patients undergoing general anesthesia for minor procedures.¹ The anesthetic machine was a regularly maintained Ohio Unitrol “three-gas” table model, and although cyclopropane is no longer used in this hospital, the rotameter and float had not been replaced by a metal tube. The rotameter assembly was protected by a thick plastic shield, which also partly obscured the rotameter bobbins when these were at a position of zero gas flow. This machine was in a cystoscopy room and used infrequently.

A previously healthy, 10-year-old Negro child weighing 34.5 kg was anesthetized for cystoscopy with thiopental, 150 mg, followed by a nitrous oxide, oxygen, and halothane mixture in a semiclosed system. The total gas flow was 6 l/min, F₁O₂ was 0.5, and the inspired halothane concentration, initially 2.0 per cent, was reduced to 1.0 per cent when induction was completed and the room darkened. After a further 8 minutes, sudden, severe bradycardia developed; it responded to administration of 100 per cent oxygen. Recovery was complete.

A request was then made to the manufacturer of the anesthetic machine for service. The machine was inspected by a service engineer, who discovered a significant leak in the system distal to the flowmeters and removed a methoxyflurane vaporizer believed to be the source of the leak.

A similar episode occurred a short time later during use of the same machine for cystoscopy of another pediatric patient. At this time, a check on the percentage of oxygen in the delivered mixture indicated a gross disparity between indicated and delivered F₁O₂’s. Another call for service was made, with a request for a check on the accuracy of the metering system. It then appeared that at a rotameter setting of 5 l/min of oxygen a volume of 400 ml was delivered. When the plastic cover was removed it was observed that the rotameter tube was absent from the cyclopropane position; it was found to be in the oxygen (D) position.

As described some years ago,² a cyclopropane rotameter tube when used for metering oxygen will deliver 20–50 per cent of the flow indicated. In this machine, however, the rotameter tubes were not marked by etching on the glass but by scales fixed to the back of the rotameter panels, and the tubes are plain except for the code letter designating the gas for which they were calibrated. As transposed, when the cyclopropane bobbin was allowed to rise to a level of 5 l/min on the oxygen scale, it corresponded to a flow of 575 ml on the cyclopropane scale. One can only speculate about how this transposition took place. A regular check on the gas flows delivered through the rotameters of anesthesia machines may be made by using any of the dry gas meters as described in the study by Byles.³ In the absence of such equipment, a check of acceptable accuracy may be made with a simple, cheap, disposable device introduced for the measurement of vital capacity and minute ventilation.⁴

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REFERENCES


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