CORRESPONDENCE

Pressure Effect on the Vernitrol Vaporizer

To the Editor.—Keet, Valentine and Riccio (page 734) have found that intermittent positive pressure ventilation results in a significant increase in halothane output of the Vernitrol vaporizer. A 1 to 2 per cent increase is obtained at the upper limit of ventilation pressures (30 cm. water) and rates (20 times per minute) ordinarily used in adults. Although there is no doubt as to the importance of this increase, it should not be assumed that it is reflected in an equal rise in inspired or alveolar halothane. The total inflow into the system was 500 ml. per minute. An average 1 to 2 per cent halothane concentration in this inflow results in a halothane input of 5 to 10 ml. per minute. This is considerably less than the average halothane uptake in man at a constant alveolar halothane concentration of 0.8 per cent.* Actual halothane uptake at 0.8 per cent alveolar concentration varies from an initial high of 80 ml. per minute to 12 ml. per minute 3 hours after the start of anesthesia. Increased Vernitrol output due to intermittent positive pressure then would ordinarily not raise the alveolar concentration by more than 0.8 per cent and would probably raise it less than 0.2 to 0.4 per cent. The external check valve reduces the halothane input to 500 times 0.003 or 1.5 ml. per minute of halothane. This is a negligible input relative to uptake and the external check valve may be considered to essentially eliminate the hazard of halothane overdoseage due to extraction of agent from the vaporizer.

The initial surge seen by the authors is of little consequence since a sudden injection of even 4 per cent halothane in 500 ml. will cause only a small increase in the inspired halothane. If the gas volume into which it were injected (anesthetic system plus patients' functional residual capacity) were 10 liters, this would result in a concentration increase of 0.2 per cent or less.

In summary, although intermittent positive pressure results in an increase in halothane output of the Vernitrol vaporizer this increase is of relatively small importance. Of greater importance is the increase input of halothane into the alveoli by the rise in ventilation. The internal check valve suggested by the authors provides absolute protection against the former hazard. The external check valve provides adequate although incomplete protection against this hazard. Neither valve eliminates the latter hazard.

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To the Editor: Dr. Eger's comments are well taken and help to place the proper perspective on this problem. The authors did not wish to imply that it is unsafe to give halothane without a check valve. Even with no check valve, the maximal sustained rise in delivered concentration in our study was 0.6 per cent higher than expected from the flowmeter settings. This would roughly correspond to a rise in inspired concentration of 0.25 per cent during closed circuit anesthesia,† and hardly seems dangerous by any standards.

With repeated starting and stopping of IPPB, however, we are not sure how high a sustained rise in output may be possible, and it is conceivable that a dangerous rise could occur.

* Eger, E. I. and Guadagni, N. P.: Halothane uptake by man at a constant alveolar concentration, Anesthesiology, 24: 299, 1963.

† Mushin, W. W., and Galloon, S.: The concentration of anesthetics in closed circuits with special reference to halothane; clinical aspects, Brit. J. Anaesth. 32: 324, 1960.