THE PERFORMANCE OF ROWBOTHAM'S VAPORIZER WHEN USED WITH HALOTHANE

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Several vaporizers for halothane have been described,[1-3] and of these the 'fluotec' temperature-compensated vaporizer has been accepted as being the most accurate. The fluotec, however, is heavy and cumbersome, and its delicate mechanism is easily disturbed. For these reasons it is not ideal for use in private anaesthetic practice. On the other hand the Rowbotham's bottle is literally pocket-size and has one moving part; for these reasons it now enjoys a certain popularity as a halothane vaporizer.

Originally designed for use with chloroform, this vaporizer has been used to administer 'trilene', ether, occasionally 'vinesthene', and now halothane. The original pattern, which incorporated a wick, has been modified[4] and is illustrated in Fig. 1.

Fig. 1. Rowbotham's vaporizer.

The bottle may be used with the Magill partial re-breathing attachment or as part of a carbon-dioxide absorption system. In this investigation it was decided to record the concentrations of halothane produced under common conditions of clinical anaesthesia.

METHOD

In the experimental circuit, oxygen was used as the carrier gas, being measured by a conventional MIE rotameter, passing from there through the Rowbotham's vaporizer. Distal to the vaporizer the gas and halothane vapour were entrained through a Riker type-E refractometer, calibrated for halothane, where the percentage concentration of halothane was read on a scale. A mercury thermometer was let into the liquid through a hole drilled in the top of the vaporizer.

Polythene tubing was used to connect the vaporizer to the analyser, since it is known that rubber absorbs halothane.[5]

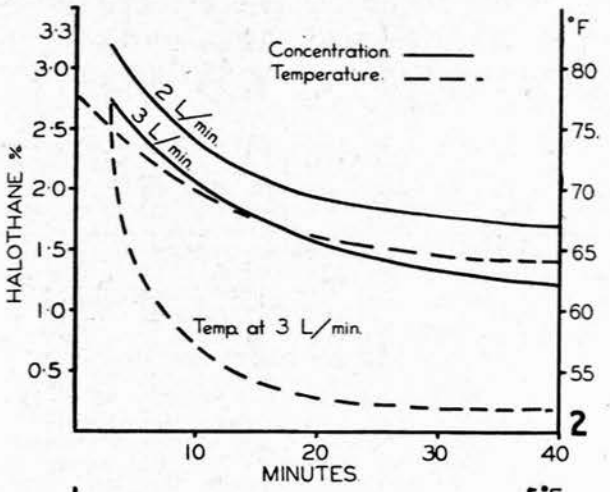
There are 6 tap settings on the vaporizer, including the 'full on' position. Two techniques were used in the investigation. First, the control lever was turned full on — position 6 — and the halothane concentration was recorded at regular intervals. The second method was to advance the lever a notch at a time and record the vapour concentration. The temperature of the liquid halothane was recorded throughout the experiments.

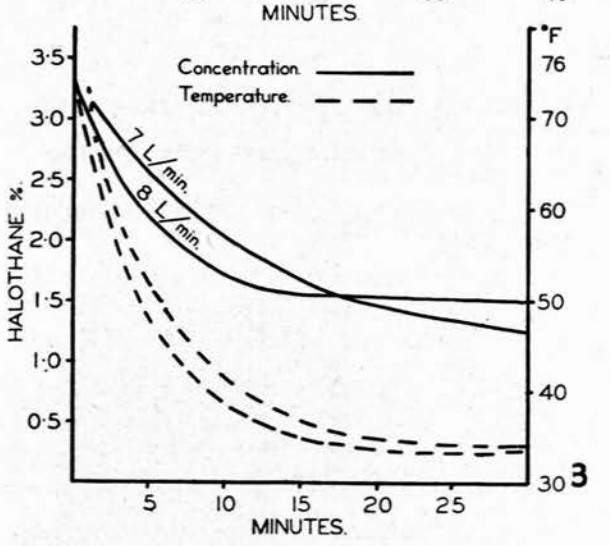
RESULTS

1. *Tap 'Full On' from the Start*

Using a flow rate of 2 litres a minute, the initial halothane concentration was found to be 3·2%, falling steadily for 30 minutes to a level of 1·8%. Thereafter a steady level of 1·7% was established. Over a 40-minute period the temperature fell from 77° to 64°F. and 5·5 ml. of halothane were used (Fig. 2).

A slightly increased flow rate of 3 litres a minute produced a similar curve, the highest concentration recorded being 2·7%, gradually levelling off at 1·3% (Fig. 2). The





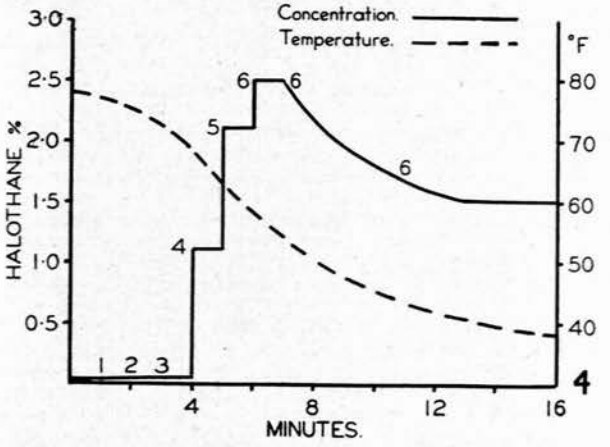


Fig. 2. Halothane concentration and temperature with vaporizer tap full on from the start — flow rates of 2 and 3 litres a minute.

Fig. 3. Halothane concentration and temperature with vaporizer tap full on from the start — flow rates of 7 and 8 litres a minute.

Fig. 4. Halothane concentration and temperature with vaporizer tap opened systematically.

fall in temperature was much greater and more rapid, and 11 ml. of halothane were vaporized in 40 minutes.

A high flow rate of 7 or 8 litres a minute produced a more rapid fall in halothane concentration from approximately 3·0% to 1·5% in 15 minutes. The fall in temperature was likewise more rapid and pronounced (Fig. 3). Halothane consumption at a flow rate of 7 litres a minute was 18 ml. in 30 minutes, and 20 ml. over the same period at a flow rate of 8 litres a minute.

2 *Systematic Opening of the Tap*

The technique employed was to advance the tap one notch a minute and to record the halothane concentration after each advance. Results are recorded in Fig. 4, the numbers against the halothane concentration curve representing the tap settings.

A flow rate of 8 litres a minute was used and it was found that from tap settings 1 - 3 the halothane concentrations were so low as to be unrecordable. At tap setting 4 a concentration of a little over 1% was recorded, and the maximum concentration obtainable by this method was 2·5% at tap setting 6. After a further 6 minutes at this tap setting, the halothane concentration fell to 1·5% and remained at approximately this level. In 15 minutes 10 ml. of halothane were vaporized.

CONCLUSIONS AND SUMMARY

1. The Rowbotham's vaporizer can be used for halothane in a partial rebreathing circuit (Magill's attachment), but the consumption of halothane is high, between 30 and 40 ml. an hour.

2. A satisfactory and economical performance was obtained with a flow rate of 2 litres a minute, indicating that this vaporizer would give adequate service when used in conjunction with a soda-lime absorption unit. If the vaporizer was incorporated outside the circuit (VOC), the inspired concentration of halothane would be somewhat less than the vaporizer concentration.[6]

3. Under normal working temperatures, with the vaporizer turned full on from the start, it was impossible to exceed a halothane concentration of a little more than 3% irrespective of the gas flow used. When the tap was opened gradually a halothane concentration of 2·5% was the highest obtainable.

4. When the control lever was advanced at 1-minute intervals, halothane concentrations were so low as to be unrecordable below tap setting 4.

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REFERENCES

1. Mackay, I. M. and Kalow, W. (1958): Canad. Med. Assoc. J., **5,** 248.
2. Brennan, H. J. (1957): Brit. J. Anaesth., **29,** 332.
3. Burton, P. J. C. (1958): *Ibid.*, **30,** 312.
4. *Idem* (1958): *Ibid.*, **30,** 434.
5. Galloon, S. (1960): *Ibid.*, **32,** 310.
6. Mushin, W. W. and Galloon, S. (1960): *Ibid.*, **32,** 324.