The Effects of Nitrous Oxide/Oxygen Mixtures on Vital Capacity

G. D. PARBROOK AND B. R. KENNEDY
The Royal Infirmary and University of Aberdeen

Abdominal operations reduce vital capacity and the effectiveness of an analgesic can be judged by the improvement of vital capacity following its administration. A blind trial was accordingly planned to assess the effect of nitrous oxide/oxygen mixtures in 12 volunteers and in 12 patients under the age of 60 who had recently had upper abdominal operations. Their vital capacities were measured by a Wright Respirometer initially and after each gas had been inhaled for 15 minutes via a B.L.B. mask. The nitrous oxide concentrations used were 25 per cent in oxygen and 15 per cent in oxygen: oxygen only was inhaled as control. The nitrous oxide mixtures were premixed and all cylinders were concealed in canvas bags, coded and used in all possible orders.

RESULTS

<table>
<thead>
<tr>
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<th>Oxygen</th>
<th>15% Nitrous oxide</th>
<th>25% Nitrous oxide</th>
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</thead>
<tbody>
<tr>
<td>Patients</td>
<td>+33.3</td>
<td>+150.0</td>
<td>+297.5</td>
</tr>
<tr>
<td>Volunteers</td>
<td>-41.7</td>
<td>+17.5</td>
<td>-5.0</td>
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In the patients, the t values for increases in means between oxygen only and 15 per cent nitrous oxide (t = 3.06; P<0.01) and between 15 per cent and 25 per cent nitrous oxide (t = 3.87; P<0.001) were both highly significant. No undesirable side effects occurred.

In the volunteers there was no indication of any significance of treatment. Nine were found after the trial to have identified the mixtures: four regarded the 25 per cent nitrous oxide as pleasant and three as mildly unpleasant to inhale.

The results indicate that nitrous oxide mixtures relieve postoperative pain and that the degree of analgesia is concentration dependent. The advantages of nitrous oxide are: lack of respiratory depression, rapid action, concurrent oxygen administration and possible euphoria and sedation. The disadvantages are: increased cost over that of morphine, the need for supervision in case side effects such as unconsciousness, nausea, and psychological disturbances occur, and the possibility of bone marrow depression if treatment is prolonged for several days.

A Proportional Respiratory Sampling Apparatus used with data processing techniques for the measurement of nitrous oxide uptake and elimination.

M. BOOKALLIL AND W. D. A. SMITH
Research Department of Anaesthetics, Royal College of Surgeons, London

Withdrawal of large gas samples from breathing systems supplied with fresh gases at low flow rates alters the characteristics of the system and is impracticable in the case of inspired gas. In any breathing system the measurement of "mixed" respired gas concentrations is difficult when variations in concentration and flow rate are unpredictable. But small samples withdrawn in such a way that the sampling rate is always a constant small fraction of the respiratory flow rate, have the same composition as the corresponding "mixed" respired gases (Smith, 1963, 1964).

Apparatus capable of withdrawing such samples has been developed and used to measure "mixed" expired concentrations of nitrous oxide during a study of the uptake and elimination of nitrous oxide in subjects inhaling 80 per cent nitrous oxide.