USE OF COMPRESSED AIR IN A CONTINUOUS FLOW ANAESTHETIC MACHINE


SUMMARY

Anaesthesia was given from a Boyle's apparatus to 100 patients, using compressed air as the carrier gas.

There is difficulty in obtaining anaesthetic gases in India. In our hospital, in 1974, there was no supply of oxygen and nitrous oxide for 183 days, a limited supply for 87 days and a full supply for 85 days only. At times supplies were insufficient even for emergency operations. We are grateful to Dr. I. C. Geddes, University of Liverpool, who suggested the use of compressed air cylinders. Although it was found that these were unavailable, the idea was pursued with the use of an oil-free air compressor.

TECHNIQUE

The compressed air from an oil-free air compressor was fed to the Boyle's apparatus as shown in figure 1. The volatile anaesthetic agents were administered in the normal manner.

Air compressor

The B & G oil-free air compressor supplied with the Bird's Respirator was used. It is powered by electricity and can store compressed air at a pressure of 345 kPa, having an automatic cut-out device when the pressure exceeds 517.5 kPa. There is a cooling coil and a safety pop-off valve, by which extra pressure is released and extra moisture in the circuit is expelled intermittently. Noise is reduced by keeping the compressor outside the operating theatre.

Connection

The Boyle's apparatus is attached to the compressor at the outlet of the cooling coil by means of thick antistatic rubber pressure tubing. A pin index block which can be fitted to either the nitrous oxide or the oxygen inlet was used.

Boyle's apparatus

A conventional Boyle's apparatus was used. A Fluotec Mark III (Cyprane, Keighley, Yorkshire) could be connected when required. The Rotameters for nitrous oxide and oxygen were recalibrated for compressed air with the help of an inertia-free
TABLE I. Calibration of nitrous oxide and oxygen rotameters for air

<table>
<thead>
<tr>
<th>Flow setting (litre/min)</th>
<th>Actual flow (litre/min)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide</td>
<td>Oxygen</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>10.0</td>
<td>10.0</td>
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<tr>
<td>Nitrous oxide rotameter</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>16.0</td>
<td>16.0</td>
</tr>
</tbody>
</table>

* Mean of three readings.

spirometer (table I). We used the nitrous oxide rotameter for air and the oxygen rotameter for additional oxygen.

PROCEDURE

One hundred unselected patients received compressed air during general anaesthesia. All were premedicated with atropine i.m. or i.v. depending upon the age of the patient and the time of starting the operation. Anaesthesia was induced with a sleep-dose of thiopentone* followed by suxamethonium 1.5 mg/kg body weight and the patients were ventilated through a mask with air. The trachea was intubated and the patient was ventilated from a Magill circuit.

Anaesthesia was maintained using one of the following in air: diethyl ether, trichloroethylene, halothane (0.5–1.5%). Myoneural block was provided by tubocurarine, gallamine or pancuronium. In a few patients anaesthesia was maintained with pentazocine given i.v. intermittently.

At the end of surgery the effect of the muscle relaxant was antagonized by neostigmine, given i.v. with atropine. The adequacy of reversal of the relaxant was judged by the absence of nystagmus, ability to lift the head and hand-grip strength.

OBSERVATIONS AND RESULTS

Eighty-four of the patients underwent elective surgery and 16 underwent emergency surgery. The age range was 1–80 yr. The operation categories were: genito-urinary (34), gastro-intestinal (27), orthopaedic (11), miscellaneous (28). The duration of the operations ranged from 30 to 300 min. The heart rate and the systolic arterial pressure were noted throughout the operation. There were no complications during anaesthesia or in the period following operation and there were no deaths. None of the patients experienced recall of any of the events during anaesthesia and operation, except two who received only pentazocine.

DISCUSSION

There are a number of reports of an increase in intrapulmonary shunt in anaesthetized patients who breathe air (Webb and Nunn, 1967; Price et al., 1969). This seems to be related more to the state of anaesthesia than to the action of individual agents. Nunn, Bergman and Coleman (1965) and Bergman (1967) have reported that there is little difference in venous admixture when the inspired oxygen concentration is changed from 21 to 100%.

However, \( \text{Pa}_\text{aO}_2 \) may still be reduced to an unacceptable value in patients with pre-existing lung disease and oxygen enrichment of the air is desirable in these circumstances.

Nevertheless, this technique is a valuable addition to the armamentarium of the anaesthetist in countries in which the supply of anaesthetic gases cannot be assured.

ACKNOWLEDGEMENTS

The authors are extremely thankful to the Principal, Dr V. N. Sharma, of the Medical College, Jodhpur, for co-operation in the present study. We are also grateful to Dr C. L. Pathak, Professor and Head of the Department of Physiology, for criticism and valuable suggestions. We extend our most sincere thanks to all the members of the Department of Surgery for their co-operation.

REFERENCES


L’anesthésie a été administrée à 100 patients à partir d’un appareil de Boyle, utilisant l’air comprimé comme gaz porteur.

SUMARIO
Se administró anestesia a 100 pacientes mediante un aparato Boyle, utilizando aire comprimido como gas transportador.