OBSERVATIONS ON DENTAL ANAESTHESIA INTRODUCED WITH METHOHEXITONE

I: INDUCTION OF ANAESTHESIA

BY

DOUGLAS S. YOUNG AND J. G. WHITWAM

The General Infirmary at Leeds, the Leeds Dental Hospital, and the Regional Thoracic Surgical Centre, Killingbeck Hospital, Leeds, England

SUMMARY

Observations have been made on 2,000 patients undergoing dental surgery under general anaesthesia in the sitting position. The anaesthetic sequence consisted of a single dose of methohexitone—mean dose, male 10.8 mg/stone (1.7 mg/kg), female 7.5 mg/stone (1.18 mg/kg); range, male 4–20 mg/stone (0.63–3.14 mg/kg), female 2–16 mg/stone (0.31–2.51 mg/kg)—followed by nitrous oxide and oxygen. Halothane was also used in 30 per cent of patients as a supplement. (Inspired concentration approximately 1 per cent.) The incidence of observed fainting at the beginning of induction was 1 in 500. The advantages and disadvantages of using relatively large doses of methohexitone are outlined and a method of overcoming the problem of respiratory depression immediately following the barbiturate is described. It is stressed that techniques using larger doses of methohexitone should be used only by those familiar with the application of controlled respiration.

The first reports of the use of methohexitone in dental anaesthesia were by Stocking (1957) and Drummond-Jackson (1960) in America and Britain respectively. It is probably true to say that this drug has become the intravenous agent of choice for dental anaesthesia. This report summarizes observations made on over 2,000 ambulant patients undergoing dental extractions under general anaesthesia introduced with methohexitone in the sitting position. The anaesthetic sequence in the majority of patients was a single dose of methohexitone, followed by nitrous oxide and oxygen, with the addition of halothane when necessary. The prime consideration in selecting the dose of methohexitone for any particular patient was to provide optimum operating conditions.

ANAESTHETIC TECHNIQUE

Patients were issued with the following written instructions: “(1) Have an adult person with you who will go home with you. (2) Have nothing to eat or drink for 4 hours before your appointment. (3) Do not drive yourself away in any form of transport. (4) Make arrangements to go home and rest for at least a few hours before starting work.” Subject to observation of these instructions acceptance for general anaesthesia was based on a brief medical history and superficial examination.

All the patients were unpremedicated and all anaesthetics were administered by one of us (D.S.Y.). The inhalational delivery system is shown in figure 1. The anaesthetic bag was used as a reservoir, rebreathing being prevented by the insertion of a non-return valve between the bag and the nosepiece. For convenience in terms of bulk, methohexitone was administered in a 1.6 per cent solution.

Previously it had been observed that there is a considerable variation in the anaesthetic requirement of unpremedicated subjects and that a dose of intravenous barbiturate based solely on body weight was unreliable. The dose of methohexitone was based on the sex, age, weight, physique, temperament and habits of the patient (particularly drinking habits where enquiry was considered relevant), and the extent of intended surgery. The presence of manifest anxiety and tension was considered to be one of the most important factors in anticipating resistance to anaesthesia. Thus, on
a weight basis, the small nervous female often received twice the dose of the obese placid type, yet management of anaesthesia and recovery were similar in both types of patient.

For females 5 ml (80 mg) and for males 9 ml (144 mg) of methohexitone solution were routinely drawn into a 10-ml syringe and a 23 s.w.g. needle fitted. Usually in the women the amount administered varied from 4 to 5 ml and in the men 7 to 9 ml. However in seven females and twenty-two males quiet sleep was not achieved with the initial dose and an additional amount of methohexitone was administered. A further two males became so violent after an inadequate dose that it was impossible to administer more barbiturate and they could not be subdued on that occasion.

After 1 ml of solution had been administered there was a brief pause in the injection while the patient was asked to swallow any saliva or mucus in the mouth or pharynx which might otherwise subsequently cause laryngospasm. An enquiry was made also as to whether the arm into which the injection was being made was still comfortable. This delay in the injection was the same for both male and female patients and therefore produced a proportionately greater effect on the injection time in the female groups who received a smaller volume of solution. The time taken to apply the nosepiece after completing the injection was fairly constant at 11 seconds.

The initial respiratory depression following methohexitone was countered by “augmenting” the respiration. The fingers of the right hand kept the jaw up and the lips closed while the thumb closed the expiratory valve on the nosepiece; at the same time the reservoir bag was compressed intermittently by the left hand, thereby inflating the lungs of the patient. The term “assisted” respiration was used when the tidal volume became small but respiratory arrest did not occur; “controlled” respiration was employed when apnoea predominated during the period of induction. The inflation pressures recorded at the nosepiece during IPPR started at zero and peaked at 5–15 cm H₂O.

When using a Walton 5 the initial oxygen setting was 10 per cent for the first six respirations and was then increased to 16 per cent until extraction of teeth commenced when a minimum of 20 per cent oxygen was administered. In prolonged cases this was gradually increased to 30 per cent. After a period of 1½ minutes from applying the nosepiece the mouth was opened by a gag and packed off by gauze roll. In practically all patients relaxation of the jaw was more than adequate. The time from starting the injection of barbiturate to commencing extraction was fairly constant at 3 minutes.

Halothane was held in reserve for those patients who did not settle after 1½ minutes administration of nitrous oxide (that is the point of opening the mouth before extraction commenced) or who later showed signs of lightening of anaesthesia (after extraction commenced) and was never used while augmenting the respiration during the induction phase. It was only introduced when adequate spontaneous respiration was present, and was administered at either two divisions on a Goldman or 1 per cent on a Cyprane vaporizer. Occasionally three divisions on the Goldman or 2 per cent on the Cyprane were needed. During maintenance, when nasal breathing was estab-
lished, only minimal tension was maintained at the expiratory valve on the nasal mask, and economy of gases and halothane during maintenance was effected by reducing the delivery pressure from the machine until the reservoir bag just adequately met the inspiratory demand. The non-return valve prevented rebreathing. Pressures recorded at the nosepiece fluctuated around zero, ranging from a maximum of +2 cm H$_2$O to a minimum of -1 cm H$_2$O.

As soon as the patient was asleep it was customary to apply a strap over the thighs to maintain the position in the chair.

OBSERVATIONS

The classification of induction complications outlined by Dundee and Moore (1961) was adopted, and appropriate observations were made on the occurrence of muscle movements and respiratory upset following the administration of methohexitone. Measurements of systolic blood pressure were made on an additional series of ninety-eight patients and these form the subject of a further communication.

The weight of the patient was assessed by interrogation and inspection (Coleman and Green, 1960). A clothing factor of 7 lb. (3.2 kg) was allowed for the men and 5 lb. (2.3 kg) for the women.

RESULTS

The age distribution of the patients is shown in figure 2, the youngest and oldest being 12 and 79 years of age respectively.

Table III shows the weight distribution of the patients.

The dose of methohexitone.

This is summarized in tables I and II. The mean volume of solution administered throughout this series was 4.4 ml (70.4 mg) for women and 8.5 ml (136 mg) for men, representing a mean dose of 7.5 mg/stone (1.18 mg/kg) for the former and 10.8 mg/stone (1.7 mg/kg) for the latter. As can be seen from table III, with increase in weight of the patients there was a considerable reduction in the dose of methohexitone expressed in terms of body weight.

FIG. 2
Age distribution of patients.
### TABLE I

Induction complications following the administration of methohexitone:

**male** (898 patients)

<table>
<thead>
<tr>
<th>Dose (mg/stone)</th>
<th>4+</th>
<th>5+</th>
<th>6+</th>
<th>7+</th>
<th>8+</th>
<th>9+</th>
<th>10+</th>
<th>11+</th>
<th>12+</th>
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<th>14+</th>
<th>15+</th>
<th>16+</th>
<th>17+</th>
<th>18+</th>
<th>19+</th>
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<tbody>
<tr>
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<td>0-94</td>
<td>1-1</td>
<td>1-26</td>
<td>1-41</td>
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<td>1-73</td>
<td>1-88</td>
<td>2-04</td>
<td>2-2</td>
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<td>I</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>2</td>
<td>8</td>
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<td>—</td>
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<td>18</td>
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<td>30</td>
<td>55</td>
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<td>49</td>
<td>29</td>
<td>4</td>
<td>6</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Laryngospasm</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>7</td>
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<td>—</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>Yawning</td>
<td>—</td>
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<td>8</td>
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<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*I—Minor movements not requiring re-positioning of patient or restraint.
II—Movements either causing alteration in the relative position of limbs and trunk, necessitating re-adjustment of the patient, requiring restraint.

### TABLE II

Induction complications following the administration of methohexitone:

**female** (1102 patients)

<table>
<thead>
<tr>
<th>Dose (mg/stone)</th>
<th>2+</th>
<th>3+</th>
<th>4+</th>
<th>5+</th>
<th>6+</th>
<th>7+</th>
<th>8+</th>
<th>9+</th>
<th>10+</th>
<th>11+</th>
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<th>13+</th>
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<td>0-63</td>
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<td>0-94</td>
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<td>1-26</td>
<td>1-41</td>
<td>1-57</td>
<td>1-73</td>
<td>1-88</td>
<td>2-04</td>
<td>2-2</td>
<td>2-3</td>
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<td>4</td>
<td>5</td>
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<td>—</td>
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<td>1</td>
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<td>9</td>
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<td>3</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>1</td>
<td>1</td>
<td>7</td>
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<td>9</td>
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<td>1</td>
<td>—</td>
<td>—</td>
<td>1</td>
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<td>—</td>
</tr>
</tbody>
</table>

*I—Minor movements not requiring re-positioning of patient or restraint.
II—Movements either causing alteration in the relative position of limbs and trunk, necessitating re-adjustment of the patient, requiring restraint.

### TABLE III

Dose of methohexitone in relation to weight of patients.

**Total number of patients: male 898; female 1102**

<table>
<thead>
<tr>
<th>Weight (stones)</th>
<th>5+</th>
<th>6+</th>
<th>7+</th>
<th>8+</th>
<th>9+</th>
<th>10+</th>
<th>11+</th>
<th>12+</th>
<th>13+</th>
<th>14+</th>
<th>15+</th>
<th>16+</th>
<th>17+</th>
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<td><strong>Male</strong></td>
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<td></td>
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<tr>
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<tr>
<td>Mean dose</td>
<td>mg/stone</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>12-3</td>
<td>12-3</td>
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<td>11-9</td>
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<tr>
<td>Mean dose</td>
<td>mg/kg</td>
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<td>mg/stone</td>
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<td>9-6</td>
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<td>8-5</td>
<td>8-3</td>
<td>7-0</td>
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<tr>
<td>Mean dose</td>
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<td>1-19</td>
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<td>0-87</td>
<td>0-86</td>
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</tbody>
</table>
Excitatory phenomena and respiratory upset.

The majority of patients went off to sleep quietly and smoothly. However, thirty-one patients became restless due to an initial inadequate dose of methohexitone. As has already been described, in twenty-nine of these a further dose of methohexitone was administered, but the remaining two patients could not be subdued on that occasion. (Anaesthesia was successfully induced at a further visit using a larger dose of methohexitone.)

The incidence of tremors, involuntary muscle movements, cough, hiccup, laryngospasm and yawning is summarized in tables I and II. Figure 3 relates the percentage incidence of muscle movement and respiratory upset to the dose of methohexitone. The incidence is seen to be higher with increase in dose.

Respiratory depression.

As has been explained, this was countered by augmenting the respiration. Figure 4 shows an increase in the frequency of use of controlled respiration with increasing dose of methohexitone.

Fainting.

Four patients fainted either on presentation of the needle or shortly after commencing the injection of barbiturate, representing an approximate incidence of 1 in 500. All were put into the horizontal position by lowering the back of the
chair and ventilated with oxygen until the volume, tension and rate of the radial pulse returned to normal. Anaesthesia was then induced with nitrous oxide, oxygen and halothane, after which the patient was cautiously returned to the sitting position before the extractions were started. No further hypotension was detected and subsequent progress and recovery were the same as in the other patients.

**Vein thrombosis.**

The relevant veins of 200 patients were examined at a later attendance and in no instance was there any sign or history of thrombosis or inflammation. None of the other patients volunteered any complaint to the dental surgeons on subsequent visits.

**Retching and vomiting.**

This did not occur during induction. Side effects due to methohexitone invariably passed off by the time extraction commenced (that is 3 minutes after commencing the injection).

**DISCUSSION**

Bourne (1960) has drawn attention to the dangers of undetected fainting in the dental chair when the patient is unable to fall to the horizontal position. The incidence of observed fainting in the present report was 1 in 500. The authors are of the opinion that providing the anaesthetist is quickly aware of the occurrence of this phenomenon, and the patient is immediately put in a horizontal position, preferably with the legs elevated relative to the thoracic cage, no serious harm will result. Frequent observation of the patient is essential, pallor and sweating being early warning signs. The pulse should be palpated before and during venepuncture and every half-minute or so during the subsequent conduct of anaesthesia.

The distinction between the sexes, in terms of requirement of barbiturate, has not been made in previous reports dealing with the use of methohexitone in dental anaesthesia. Price (1960) has suggested that the initial fall in the effective level of thiopentone is due to redistribution of this drug into the lean body mass (muscle, connective tissue, skeleton, etc.). The distribution of methohexitone during the 10 minutes or so following administration is probably similar to that of thiopentone (Welles, McMahon and Doran, 1963; Brand et al., 1963). The proportionately greater amount of lean body mass in men, as compared with women, would partly explain the larger dose of barbiturate required in the former. Again this would also be a factor determining the relatively smaller dose of barbiturate required for the large obese subject as compared with the thin wiry individual. The doses used in most of the patients in this report were somewhat greater than those suggested by other authors working in this field. It would seem that there are two choices in selecting the dose of the barbiturate. Either the anaesthetist can administer a small dose of methohexitone, sufficient to secure hypnosis for a brief period, in which case, except for the shortest procedures, subsequent anaesthesia will depend primarily on the inhalational sequence; or a larger dose can be used so that the barbiturate will help to keep the patient subdued during more protracted surgery. The use of larger doses of methohexitone can be justified on two main points. Firstly, establishment of nasal breathing, induction and maintenance of anaesthesia are all made easier. Secondly, operating conditions are better (Goldman, 1963). Also, as has been described above, on occasion an inadequate dose of methohexitone will produce a “fighting patient”. Furthermore halothane will be required less frequently and in this series it was used in only 30 per cent of patients.

The advantages gained by use of more liberal doses of methohexitone must be balanced against the potential disadvantages in the form of the side effects of this agent.

The data presented above confirm the findings of Dundee et al. (1961) that increasing the dose of methohexitone on a weight basis can be expected to produce a higher incidence of abnormal muscle movement and respiratory upset during induction. The bulk of these complications are principally of nuisance value and the most serious complication in this group is laryngospasm. However, when this appears in the period when the patient is mainly under the influence of methohexitone, it is usually mild and passes off rapidly, a point discussed by Taylor and Stoelting (1960). One case of severe spasm occurred in the series, but with careful attention to the airway
and administration of oxygen the position rapidly improved and the dental procedure was completed.

Another potential danger following methohexitone is the occurrence of severe respiratory depression and apnoea. The incidence of the latter is related to the total dose, speed of injection, type of premedication, individual response, etc., and the literature on this subject has already been reviewed by one of us (Whitwam, 1962). In the majority of individuals, when methohexitone is administered in doses within the accepted therapeutic range, adequate ventilation will return soon enough, following the initial respiratory depression, to prevent any serious degree of asphyxia. In only a small percentage of patients is assistance by artificial ventilation essential. In dental work, all the time that ventilation is reduced in the initial stages the effect of the barbiturate is rapidly waning, and valuable time is lost in raising the tension of nitrous oxide in the patient while respiratory exchange is reduced below normal by the barbiturate. Thus it would seem reasonable to augment the tidal volume by gently inflating the patient’s lungs with nitrous oxide and oxygen. If this approach is adopted, the tidal exchange of all patients manifesting respiratory depression following the barbiturate injection can be augmented by intermittent positive-pressure respiration, so that the replacement of lung nitrogen by nitrous oxygen occurs more rapidly. Thus apnoea or severe respiratory depression will cease to be a problem. Such a method has the added advantage of preventing hypoxaemia in the occasional patient who develops a period of relatively prolonged apnoea. In only five patients was respiration still depressed when the extractions were started, and on application of forceps to remove the first tooth vigorous spontaneous breathing returned in every instance. Although a full face mask, oro- and nasopharyngeal airways, and facilities for tracheal intubation were always available, these were never needed.

For the anaesthetist experienced in the use of controlled ventilation the induction period will be easier to manage and should present few problems using the dose of methohexitone and the methods outlined above. However, the individual who is inexperienced in formal anaesthetic methods would be advised to adhere to a smaller dose scheme thereby minimizing respiratory depression. Techniques based on relatively small doses have been described by Coleman and Green (1960), Green and Jolly (1960), and Goldman and Harris (1963).

ACKNOWLEDGMENTS

The authors wish to thank Eli Lilly and Co. Ltd., for their generous supplies of methohexitone.

REFERENCES


Des observations ont été faites sur 2000 patients chez lesquels des interventions de chirurgie dentaire furent faites sous anesthésie générale, toujours en position assise. Les anesthésiques administrés successivement furent les suivants : méthohexitone—une seule dose. Dose moyenne : pour hommes 1.7 mg/kg ; pour femmes 1.18 mg/kg. Amplitude-limite max. et min. : pour hommes 0.63 à 3.14 mg/kg, pour femmes 0.31 à 2.51 mg/kg ; suivis de protoxyde d'azote et d'oxygène. Chez 30 pour cent des patients on donna également de l'halothane à titre de supplément (concentration inspirée env. 1 pour cent). L'incidence observée de perte de conscience au début de l'anesthésie était de 1 sur 500. Les auteurs signalent avantages et inconvénients de l'emploi de doses relativement fortes de méthohexitone et indiquent une méthode pour venir à bout de la dépression respiratoire immédiatement après administration du barbiturique — ils font remarquer que des méthodes utilisant de fortes doses de méthohexitone ne devraient être employées que par des médecins familiarisés avec l'application de la respiration contrôlée.

THE XIV FRENCH CONGRESS OF ANAESTHESIOLOGY

Organized jointly by the
National Syndicate of French Anaesthesiologists,
French Association of Anaesthesiologists,
French Society of Anaesthesiology, Analgesia and Reanimation,
will be held in Nice on May 15, 16 and 17, 1964.

The Scientific programme will be held in the Exhibitions Palace and the programme is as follows:

1. A report followed by papers on the following subject : "The heart and anaesthesiology" by Dr. P. Jaquenoud.
2. Programmed discussions on:
   "Halogens" by Dr. R. Deleuze.
   "Monitoring in anaesthesiology" by Dr. E. Echter.
3. Symposium on "Treatment of anaesthetic emergencies."
4. Meetings on unscheduled reports.
5. "Role of neuroglia in the central nervous system" by Dr. H. Laborit.

The Congress will be preceded on May 14 by a meeting of the Association of European Anaesthesiologists which will result in the publication of two reports on:
   "The organization of reanimation centres" by Prof. E. Cioatto of Turin.
   "Nurse auxiliaries in anaesthesiology" by Prof. agrg. J. du Cailar of Montpellier.

Unscheduled reports on "The heart and anaesthesiology" will be accepted in a limited number. Title and summary (15 typewritten lines) should reach the General Secretary by February 25.

For information and entry, apply to General Secretary: Docteur P. Maestracci, Centre de Transfusion Sanguine, Rue Delille, Nice, A.-M. France.