ANÆSTHESIA WITH
METHYL-N-PROPYL ETHER

WITH SPECIAL REFERENCE TO THE CHANGES IN THE
ELECTROCARDIOGRAM AND BLOOD SUGAR

By A. R. HUNTER

METHYL-N-PROPYL ETHER, which is an isomer of ordinary di-ethyl ether, has been used quite extensively both in man (White et al., 1946; Carr et al., 1947; Fisher and Whitacre, 1947; Rochberg, 1947; Shane, 1947) and animals (Krantz et al., 1946) for the production of general anaesthesia. At the time at which this drug was introduced it seemed that it might have a fairly wide application in clinical work. The need for lipoid soluble anaesthetics has, of course, been greatly reduced since the general adoption of curarization as a means of producing abdominal relaxation. None the less, it seemed that it might be of interest, if not of immediate practical value, to investigate the effect of methyl-n-propyl ether on the rhythmicity of the heart and on the blood sugar.

Methods. A series of patients undergoing a variety of surgical procedures (Table I) were premedicated with 1/3 gr. (22 mg.) of omnopon and 1/300 gr. (0.2 mg.) of scopolamine. They were anaesthetized by the intravenous injection of 1.0 g. of Kemithal (sodium cyclohexenyl allyl barbiturate). Anaesthesia was maintained with nitrous oxide and oxygen in the proportions of 6:2 and to this methyl-n-propyl ether vapour was added. The amount of oxygen was increased as the anaesthesia deepened and during some of
the operations oxygen alone was finally used as the vehicle for the vapour.

**Table I**

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Operation</th>
<th>Duration of Anaesthesia (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Paramedian Appendicectomy</td>
<td>40</td>
</tr>
<tr>
<td>2.</td>
<td>Hysterectomy</td>
<td>50</td>
</tr>
<tr>
<td>3.</td>
<td>Paramedian Appendicectomy</td>
<td>40</td>
</tr>
<tr>
<td>4.</td>
<td>Do. do.</td>
<td>20*</td>
</tr>
<tr>
<td>5.</td>
<td>Do. do.</td>
<td>20†</td>
</tr>
<tr>
<td>6.</td>
<td>Do. do.</td>
<td>40‡</td>
</tr>
<tr>
<td>7.</td>
<td>Subtotal Thyroidectomy</td>
<td>60</td>
</tr>
<tr>
<td>8.</td>
<td>Removal Toxic Adenoma of Thyroid</td>
<td>40</td>
</tr>
<tr>
<td>9.</td>
<td>Removal Parotid Tumour</td>
<td>30</td>
</tr>
<tr>
<td>10.</td>
<td>Do. do.</td>
<td>35</td>
</tr>
<tr>
<td>11.</td>
<td>Removal Simple Adenoma of Thyroid</td>
<td>30</td>
</tr>
</tbody>
</table>

* Relaxation inadequate—change to di-ethyl ether after 20 minutes.
† Relaxation inadequate—patient curarized after 20 minutes.
‡ Relaxation only barely adequate when anaesthesia was carried beyond the point of respiratory arrest.

A standard Cambridge electrocardiograph was employed and recordings of the ordinary leads I, II and III were made before anaesthesia was induced. Thereafter only lead II was used. Records were made after giving the Kemithal and at various phases during the anaesthesia. An attempt was made in each of the cases studied to obtain a record under the deepest anaesthesia which could be produced. For this purpose narcosis was carried to the point of respiratory arrest in 2 cases.

Blood sugar determinations were carried out by the Maclean method on specimens of oxalated blood. These estimations were made within 2 to 2½ hours of withdrawal.
FIG. 1
A-V Nodal Rhythm during Anaesthesia with Methyl-n-propyl Ether. (Lead II Records)

FIG. 2
Irregularity of Supraventricular Origin during Anaesthesia with Methyl-n-propyl Ether. (Lead II Records)

A.R.H.
RESULTS

Cardiographic Studies. In all, 36 records were made from 4 patients. There were no abnormalities of rhythm in the initial records nor were any observed after the Kemithal. No premature beats of ventricular origin were seen in any of the tracings. One patient had a displaced pacemaker early in the anaesthetic (Fig. 1), a finding which is of no particular significance. Another patient whose P-waves were unfortunately too flat to give any indication of auricular activity developed an irregularity during anaesthesia but her ventricular complexes remained unchanged in form (Fig. 2). Further, this woman's initial electrocardiogram indicated a considerable degree of myocardial damage and she may well have been subject to attacks of paroxysmal auricular fibrillation in the absence of anaesthesia. Apart from these special findings the records obtained indicate a general slowing of the heart rate under deep anaesthesia.

The conclusions to be drawn from this brief investigation would seem to be that the action of methyl-n-propyl ether on the cardiac function is unimportant. As Krantz and his colleagues (1947) have shown in animals, it has no tendency to sensitize the myocardium to the action of the sympathomimetic drugs and therefore its use is unlikely to be associated with the risk of primary cardiac failure.

Blood Sugar Changes. These are shown in the accompanying diagram (Fig. 3). The blood sugar rose during the anaesthetic in 9 out of 10 cases studied. The extent of the rise was, as would be expected from the number of factors which influence it, somewhat variable but in general its amount was about the same as would have occurred had di-ethyl ether been used (Minnitt, 1932). It is, however,
greater than that reported by Neff and Stiles (1936) after the administration of cyclopropane and less than that mentioned after a chloroform-ether mixture (Mackay, 1927).

In 5 out of the 10 cases the blood sugar was followed during the early part of the recovery period. In 4 of these it declined to a level approximating to that at which it had been before the induction of anaesthesia. In the fifth case the blood sugar rose still higher. Since it is said that the hyperglycaemia due to di-ethyl ether lasts for 24 hours or more (Mackay, 1927; Atkinson and Ets, 1922) it is possible that recovery is faster when methyl-n-propyl ether is used.
Other Observations. In the course of this investigation some incidental observations have been made on the other actions of methyl-\textit{n}-propyl ether. Thus it was noted that peristalsis continued even under deep anaesthesia, that the blood-pressure might rise or fall or remain unaltered while the pulse rate was generally slow. This phenomenon was particularly noteworthy in the two cases of toxic goitre to whom methyl-\textit{n}-propyl ether was given without any suggestion of the increase of heart rate which so often occurs when di-ethyl ether is given to such patients. In 2 of the 6 abdominal operations in which the drug was used abdominal relaxation was unsatisfactory and other agents had to be substituted. In a third anaesthesia had to be carried beyond the point of respiratory arrest before abdominal closure could be performed. Contrary to what has been reported by others it was found that recovery of consciousness was no more rapid than when di-ethyl ether had been used and not one of the patients from whom post-operative blood specimens were taken was fully awake.

The properties of methyl-\textit{n}-propyl ether, therefore, closely resemble those of its di-ethyl isomer. It can, however, claim to be without action on intestinal peristalsis and to have little tendency to accelerate the thyrotoxic heart, but these properties are by no means unique. It is explosive and therefore cannot be used with absolute safety when the diathermy is being employed. It may fail to afford adequate abdominal relaxation and this very markedly limits its field of application. Unless this drug proves on investigation to have other properties which make it of particular value in one of the special fields of anaesthesia it can have only a small claim to be included in the armamentarium of the modern anaesthetist.
SUMMARY

The effect of methyl-n-propyl ether on the cardiac rhythm and on the blood sugar have been studied. They resemble those of di-ethyl ether in that the heart beat is little affected while the blood sugar rises quite markedly. For these and other reasons which are discussed in this paper it seems that there is little to be gained by the substitution of methyl-n-propyl ether for other agents in use at present.

I am indebted to Miss Corner, who operated the electrocardiograph; to Dr. A. Morgan Jones, who assisted me in the interpretation of the tracings; to Dr. J. C. Kerrin, in whose department the blood-sugar estimations were performed; and to Mr. N. W. Bolton, who operated on the patients. The methyl-n-propyl ether used in the investigation was generously provided by Messrs. Duncan, Flockhart and Co. Ltd.

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