METHOXYFLURANE ANALGESIA FOR BURNS DRESSINGS: EXPERIENCE WITH THE ANALGIZER*

BY

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SUMMARY

Methoxyflurane has been used to provide analgesia for burns dressings on sixty occasions in eleven patients. It was administered by way of a new, disposable vaporizer, the Analgizer, which is described. Three patients required either supplementary analgesics or tranquillizers. No side effects were noted, and patient acceptance of the Analgizer was good. This method is thought to represent an advance over previous methods of analgesia for burns dressings, since there is no undue sedation, pre-operative starvation is unnecessary, and venepuncture is avoided.

This paper describes our experiences using a disposable methoxyflurane dispenser to provide analgesia during repeated burns dressings. This dispenser is known by the trade name of Analgizer (Abbott).* The provision of analgesia for burns dressings is difficult, since frequent, often daily, dressings are necessary. The anaesthetic or analgesic requirements for these dressings may retard a patient's progress unless special care is taken not to interfere with: (1) maintenance of acid-base, fluid and electrolyte balance; (2) maintenance of adequate nutrition; (3) preservation of intravenous or intramuscular injection sites in anticipation of major operative procedures; (4) prophylactic and therapeutic respiratory care, particularly in patients suffering respiratory tract burns; and (5) the patient's emotional stability and psychological acceptance of his illness, his long convalescence and repeated operations. Therefore, the analgesic technique used must neither aggravate the patient's problems nor cause anxiety or fear. Yet it should permit the patient to co-operate during the dressing or minor operative procedure. Preferably it should not cause prolonged sedation, respiratory or cardiovascular depression, occasional nausea and vomiting, and carry the risk of addiction; unless very high doses were used, analgesia was inadequate. Nitrous oxide analgesia was difficult to administer, particularly to children and patients with facial burns, and it frequently caused excitement. In 1966, Smith and Hollis reported the use of neuroleptanalgesia which remained the method of choice in this Burns Centre until December 1968. However, it also caused prolonged sedation. We thought that methoxyflurane analgesia might overcome many of the problems seen in the past. We have, therefore, used methoxyflurane, delivered via the Analgizer, as a analgesic for burns dressings. A description and evaluation of our technique follows.

METHOXYFLURANE

Methoxyflurane was introduced into clinical anaesthesia by Artusio and associates in 1960. Its vapour pressure is only 25 mm Hg at 20°C; its blood/gas and oil/gas partition coefficients are 13 and 825 respectively (Eger and Shargel, 1963).


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* This device is not yet marketed in the United Kingdom.
and the rubber/gas and soda-lime/gas partition coefficients are 630 (Titel and Lowe, 1968) and 7.4 (Titel and Lowe, 1968, unpublished) respectively. Hence it has lengthy induction and recovery times. However, since its minimum anaesthetic concentration (MAC) is only 0.16 volumes per cent (Saidman et al., 1967), it can be a useful adjuvant during general anaesthesia. But it can equally well be used by itself to produce analgesia without anaesthesia.

Methoxyflurane has been administered for analgesia in obstetrics by Bodley and associates (1966) and Major, Rosen, and Mushin (1967). It has also been administered for its analgesic and “mood-modifying” properties in dentistry by Dragon and Goldstein (1967). Analgesia in these situations has been produced by intermittent inhalation, administered both by the patients themselves and by anaesthetists. The Cyprane, Duke, and Tecota portable draw-over vaporizers have all been used. These are relatively expensive, bulky and, in addition, may be a potential source of cross-infection, particularly in a busy burns centre.

**THE ANALGIZER**

The Analgizer (fig. 1) is a simple, drawthrough methoxyflurane vaporizer which is disposable. It was designed primarily for self-administration. It is a polyethylene tube 15 cm long with an outside diameter of 2.4 cm. Its wall is 2 mm at its thickest. Two cm of one end of the tube are partially flattened (2.1 x 0.7 cm) to form a mouthpiece, the shoulder of which fits an anaesthetic face mask (fig. 2). A 1.0 x 0.6 cm diluter opening is located 7.6 cm from the mouthpiece end. The tube distal to the diluter opening contains a 10 x 9.5 x 0.3 cm polypropylene felt wick which, having been rolled and inserted into the tube, acts both as a reservoir and vaporizing surface for the liquid methoxyflurane charge. Distally a retaining ring and baffle disc prevent the wick from moving, but still allow passage of air and liquid. The entire unit weighs about 30 g, uncharged.

The Analgizer is charged with 15 ml of liquid methoxyflurane by pouring it into the distal end slowly enough to allow absorption by the wick. The patient is instructed to hold the instrument himself and place the mouthpiece between his lips. He inhales through it and exhales through his nose. As he becomes accustomed to the vapour the diluter opening is gradually covered.

The Analgizer delivers a maximum of 0.8 per cent methoxyflurane vapour. One 15 ml charge may last up to 4 hours if used intermittently. For prolonged use, it can be recharged repeatedly. A single unit should not be used for more than one patient.

**METHODS**

It was decided to use the Analgizer to provide analgesia for dressings and minor operative procedures on all patients admitted to the Burns Centre during the months December 1968 to March 1969 inclusive. The older children and adult patients were shown the Analgizer and its use explained to them either by the anaesthetist
or, for those patients who spoke no English, by an interpreter.

Self-administration of methoxyflurane via the Analgizer was encouraged. However, if the patients could not hold it or use it efficiently themselves, the instrument was held by the anaesthetist. An anaesthetic face mask was sometimes used (fig. 2).

Pre-operative medication and starvation were intentionally avoided. Experience with each patient dictated whether pre-operative medication was used for any subsequent administration (see results). Intra-operative analgesics were administered intravenously if the patient was (a) unable to use the Analgizer sufficiently well to obtain an adequate methoxyflurane blood level, (b) undergoing a particularly painful dressing (occasionally procedures which started as simple routine dressings became minor desloughing operations), or (c) particularly anxious, frightened, distressed, or unco-operative.

The Analgizer was charged shortly before the procedure was begun, and recharged as necessary. The dressing was started after the patient had inhaled through it for 5 minutes with the diluter opening fully covered, or earlier if signs of sedation (drowsiness, decreased lid reflex, obvious mental and physical relaxation) appeared. Administration was then intermittent as required to keep the patient free from pain or anxiety.

Assessment of analgesia was difficult and was based on the patient's subjective sensations and the objective observation of mental and physical relaxation and responsiveness. The effect obtained was graded as follows:

- **Very good** = total analgesia with full mental and physical relaxation.
- **Good** = slight discomfort insufficient to cause anxiety.
- **Fair** = discomfort, causing some anxiety but not severe enough to require supplementary drugs.
- **Poor** = discomfort or anxiety sufficient to require supplementary analgesics or tranquillizers.

A number of precautions were taken. These included the presence of an anaesthetist throughout every administration. Also, supplementary anaesthetic and resuscitation equipment was readily available.

**RESULTS**

The Analgizer was used to provide methoxyflurane analgesia for eleven patients on sixty occasions during the trial period of four months. Table I includes the relevant information. The

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (yr)</th>
<th>Sex</th>
<th>% Burn</th>
<th>No. of administrations</th>
<th>Average duration of administration (min)</th>
<th>Patient acceptance*</th>
<th>Degree of analgesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>49</td>
<td>F</td>
<td>45</td>
<td>12</td>
<td>65</td>
<td>Very good</td>
<td>Good to very good</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>F</td>
<td>20</td>
<td>1</td>
<td>45</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>M</td>
<td>30</td>
<td>9</td>
<td>90</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>M</td>
<td>65</td>
<td>14</td>
<td>62</td>
<td>Very good</td>
<td>Fair to very good</td>
</tr>
<tr>
<td>5</td>
<td>42</td>
<td>F</td>
<td>30</td>
<td>1</td>
<td>20</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>6</td>
<td>35</td>
<td>M</td>
<td>10</td>
<td>5</td>
<td>35</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>M</td>
<td>30</td>
<td>7</td>
<td>54</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>8</td>
<td>16 mths</td>
<td>F</td>
<td>10</td>
<td>2</td>
<td>25</td>
<td>Good</td>
<td>Very good</td>
</tr>
<tr>
<td>9</td>
<td>76</td>
<td>M</td>
<td>30</td>
<td>3</td>
<td>43</td>
<td>Good</td>
<td>Very good</td>
</tr>
<tr>
<td>10</td>
<td>57</td>
<td>F</td>
<td>35</td>
<td>2</td>
<td>50</td>
<td>Very good</td>
<td>Good</td>
</tr>
<tr>
<td>11</td>
<td>5</td>
<td>F</td>
<td>25</td>
<td>4</td>
<td>31</td>
<td>Good</td>
<td>Fair to good</td>
</tr>
</tbody>
</table>

* See text for definition of descriptive terms.
age range was from 16 months to 76 years and the percentage body surface burnt ranged from 10 to 65 per cent. The procedures requiring analgesia included not only routine dressings but also the application of stored skin (allo- and autografts) to raw areas.

Patient acceptance was very good. The only exception was patient 5 who neither understood nor spoke English and was, therefore, frightened and unco-operative. She refused to accept the Analgizer. Patient 3 declined methoxyflurane after the 9th administration because almost complete skin cover had been achieved and his dressings were becoming less painful. They were subsequently carried out with 15-20 mg intramuscular papaveretum.

Administration was usually intermittent and varied from 25 minutes to 2½ hours. Onset of analgesia occurred 3-5 minutes after starting the administration and was always clinically established at 10 minutes. After 20-30 minutes some patients became drowsy but all remained co-operative and able to maintain a conversation.

Patients 1, 2, 6 and 7 all learnt to hold the Analgizer themselves. Patient 1 was particularly interesting in that a tracheostomy had been performed shortly after her admission to reduce respiratory deadspace and allow tracheobronchial toilet. She quickly learned to connect and remove the Analgizer from her tracheostomy tube herself. The instrument was held by the anaesthetist for patients 3 and 4, who had burnt hands, and for patients 9 and 10 who had Parkinsonian tremors. An anaesthetic mask was used for the children, patients 4, 7, 8 and 11 (fig. 3). The adult patients were able to control the degree of analgesia voluntarily in three ways: (1) by varying the frequency or depth of inspirations through the device; (2) by varying the size of the diluter opening; or (3) by using it intermittently.

Neither excitation nor any untoward reactions were seen at any time. Respiratory rate and depth varied with the surgical stimuli, but were never obviously depressed. Blood pressure was not measured in these patients because of the technical difficulty of placing a cuff on burnt limbs. There was no nausea or vomiting during or after any dressing. Both analgesic and "mood-modifying" effects were seen. The former was adequate on most occasions. The latter took the form of sedation, dissociation from the surroundings, or amnesia. While the sedative effect became less marked with subsequent administrations there appeared to be no difference in the degree of analgesia or the dissociative effect. Within 15 minutes of the end of administration patients were fully alert and able to eat and drink normally.

Supplementary drugs were given to three patients (table II). Patient 1 was particularly anxious at the time of the 7th dressing. For this reason intravenous droperidol was given and had the desired calming effect. Patient 3 was premedicated for the first four dressings with intravenous droperidol because he was emotionally upset by the extent of his burn; this had necessitated right through-knee amputation. It was initially difficult to establish rapport with him, because of his limited English. His 3rd dressing was very painful, lasted 2½ hours, and he required phenoperidine and a further dose of droperidol at 1½ hours. As he became accustomed to the Analgizer, supplementary drugs became unnecessary (5th-9th dressings inclusive). Patient 4 was 12 years old and emotionally labile. He spoke no English's, so reassurance during dressings was impossible. He required supplementary analgesics or tranquillizers on those occasions when the dressings were particularly painful (3rd and 5th). He was premedicated with intramuscular papaveretum on two occasions when he was specially agitated (8th and 10th dressings).

Since analgesia persisted for up to 30 minutes, none of the patients required postoperative drugs.
TABLE II

Details of drug supplementation of methoxyflurane analgesia.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Dressing</th>
<th>Supplementary drugs</th>
<th>Route</th>
<th>Dose (mg)</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7th</td>
<td>Droperidol</td>
<td>i.v.</td>
<td>2.5</td>
<td>Anxiety</td>
</tr>
<tr>
<td>3</td>
<td>1st</td>
<td>Droperidol</td>
<td>i.v.</td>
<td>2.5</td>
<td>Anxiety</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>Droperidol</td>
<td>i.v.</td>
<td>2.5</td>
<td>Anxiety</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>Droperidol</td>
<td>i.v.</td>
<td>5.0</td>
<td>Anxiety and pain</td>
</tr>
<tr>
<td></td>
<td>4th</td>
<td>Droperidol</td>
<td>i.v.</td>
<td>2.5</td>
<td>Anxiety</td>
</tr>
<tr>
<td>4</td>
<td>3rd</td>
<td>Papaveretum</td>
<td>i.v.</td>
<td>4.0</td>
<td>Anxiety, pain and inability to understand English</td>
</tr>
<tr>
<td>5th</td>
<td></td>
<td>Droperidol</td>
<td>i.v.</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>8th</td>
<td></td>
<td>Phenoperidine</td>
<td>i.v.</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>10th</td>
<td></td>
<td>Papaveretum</td>
<td>i.m.</td>
<td>10.0</td>
<td></td>
</tr>
</tbody>
</table>

Some patients exhibited retrograde amnesia and would deny having seen or used the Analgizer when it was presented on a subsequent occasion. Often they did not recall previous dressings.

COMMENTS

We have found that methoxyflurane delivered via the Analgizer provides an adequate level of analgesia for burns dressings without causing undue sedation or the need for pre-operative starvation. All members of the anaesthetic department who have used the Analgizer are unanimous in their praise of it. The surgeons are in favour of the technique because it allows them to carry out minor operative procedures which might otherwise require general anaesthesia. The nursing staff like this simple method of providing analgesia because the patients are quiet and cooperative during the dressings. In addition, they require no special recovery care since they are fully alert and able to eat and drink immediately after the procedure.

Methoxyflurane analgesia provides a welcome and acceptable alternative to repeated venepuncture. At the present time it remains the method preferred in the Burns Centre.

ADDENDUM

Since the paper was submitted for publication further experience has been gained so that to date the method has been used on 168 occasions in 32 patients. There have been no untoward effects, side effects or complications, thus confirming the earlier observations.

ACKNOWLEDGEMENTS

We are grateful to our medical and nursing colleagues for their help, to Dr. Russell M. Davies for his encouragement, and to Mr. C. R. McLaughlin for his help in preparation of this article. We are grateful to Abbott Laboratories who supplied the Analgizers and methoxyflurane.

REFERENCES


METHOXYFLURANE ANALGESIA FOR BURNS DRESSINGS

ANALGESIE AU METHOXYFLURANE POUR LE PANSEMENT DES BRULURES: EXPERIENCE AVEC L’ANALGIZER

SOMMAIRE

Methoxyflurane a été utilisé comme analgésique pour le pansement de brûlures, à 60 reprises chez 11 patients. Le produit fut administré à l’aide d’un nouveau vaporisateur à usage unique, l’Analgizer, dont l’auteur donne la description. Trois patients ont eu besoin d’analgésiques ou tranquillisants supplémentaires. Aucun secondaire n’a été observé, et les malades ont bien accepté l’Analgizer. Les auteurs croient que cette méthode est un progrès par rapport aux techniques d’analgésie existantes pour le pansement des brûlures, puisqu’elle ne cause pas de sédation superflue, que le jeun préopératoire n’est pas nécessaire, et que les ponctions veineuses sont évitées.

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