THE IMMEDIATE POSTOPERATIVE CARE OF THE MYASTHENIC PATIENT FOLLOWING THYMECTOMY

BY

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SUMMARY

The problems which arise in dealing with the myasthenic patient in the immediate postoperative period following thymectomy are discussed. The indications for and advantages of spontaneous ventilation, elective tracheostomy and intermittent positive pressure ventilation are considered and the benefits of managing all such cases in an intensive care unit are stressed. It is considered that only in patients in whom the disease is limited to overt involvement of the limb and eye muscles is a trial of spontaneous ventilation indicated. Anticholinesterase drugs can be omitted for the first few days using the regimes which are suggested and the advantages of this are stressed. The detailed management of two cases is described.

Thymectomy is now an established method of treatment in selected cases of myasthenia gravis. The pre-operative management, selection of suitable cases, surgical management and postoperative care require the co-operation of a number of different specialists. In the immediate postoperative period, however, the morbidity and mortality are largely related to respiratory complications (Musselman and Porter, 1960; Viets and Schwab, 1960) and the intensive care of the patients at this time devolves largely on the anaesthetist. The introduction of intensive care units with easy access to blood gas analysis has greatly facilitated the management of these cases (Schwab et al., 1964).

TECHNIQUE OF ANAESTHESIA

The anaesthetic technique for thymectomy is now well established. Whereas previously attempts were made to increase the dose of the anticholinesterase pre-operatively and then to administer suxamethonium or a small dose of tubocurarine, halothane, or less frequently cyclopropane, is now used as the main anaesthetic agent without recourse to muscle relaxant drugs. Endotracheal intubation and controlled ventilation can be achieved with the use of small amounts of the volatile agents and are facilitated by omitting the dose of anticholinesterase due just prior to operation. If the anaesthetist uses low concentrations of these volatile agents and avoids the use of relaxant drugs, reflex depression at the end of operation is unlikely to be due to the anaesthetic technique itself.

POSTOPERATIVE PROBLEMS

The main problem at this time is the establishment and maintenance of adequate ventilation in the face of: (1) weakened respiratory musculature; (2) pain from the median sternotomy wound; (3) secretions which may be increased by anticholinesterase drugs; and (4) narcotic analgesic drugs producing central respiratory depression.

The anaesthetist may group myasthenic patients according to the overt involvement of certain muscle groups by the disease. Thus it may principally affect the respiratory muscles, the bulbar muscles, causing dysphagia, or the limb musculature, although in some patients more than one group is involved. It should be remembered, however, that even muscles not clinically weak show an abnormal response to the decamethonium test (Wylie and Churchill-Davidson, 1960), and while patients with a history of respiratory embarrassment or dysphagia are obviously liable to have respiratory difficulties postoperatively, even those patients with only limb muscle involvement may develop respiratory insufficiency postoperatively.

There are two approaches to this problem.

Trial of spontaneous ventilation.

At the end of the operation spontaneous ventilation is allowed to return and an adequate...
respiratory exchange is obtained by administration of an appropriate dose of neostigmine and atropine. The dose will vary with the patient's pre-operative requirements and the degree to which the respiratory muscles were involved. In some cases the pre-operative dose is given, while, in others, the drug is titrated until a minute volume is achieved which will ensure normal blood gas values. If the disease process has not affected the respiratory muscles at any time and there is no dysphagia, neostigmine may be omitted altogether.

Once the patient is returned to his bed the minute volume and respiratory rate are regularly monitored and the arterial blood gases including oxygen are measured using the Astrup technique. Any metabolic acidosis is corrected and oxygen is given if the arterial saturation is low.

If the arterial carbon dioxide tension is within normal limits then the minute volume and respiratory rates at the time of sampling are noted and deemed adequate. Provided the rate and volume measurements remain stable, micro-Astrup readings are taken twice daily, but if it is technically difficult to obtain accurate minute volume readings (because of the facial contour, for example) or, if these fall or the respiratory rate rises, recourse is had to more frequent blood gas analysis.

The state of the lungs is checked clinically and radiologically and physiotherapy employed from an early stage. Minimal doses of analgesics are given to relieve pain, bearing in mind that inadequate dosage will not relieve the pain and the patient will not breathe satisfactorily, while large doses will depress respiration centrally. It is often useful to administer the chosen analgesic slowly and in dilute solution intravenously until the patient's requirements are known.

Any deterioration in respiratory homeostasis is an indication that the trial is likely to fail or has failed and tracheostomy should be performed and intermittent positive pressure ventilation commenced.

**Immediate tracheostomy and intermittent positive pressure ventilation.**

An alternative to the trial of spontaneous ventilation is to perform a tracheostomy at the end of operation while the endotracheal tube is still in place. A cuffed rubber tube is inserted and the patient returned to bed. This reduces the deadspace in the airway and allows secretions to be easily removed as required. While it is possible at this stage to restore normal spontaneous ventilation using the anticholinesterase drugs it is more usual to connect the tube to a patient-triggered ventilator and to assist ventilation for a period. In this case no anticholinesterase is given and nasogastric feeding is instituted if necessary.

The minute volume, respiratory rate and inflation pressure are easily measured and controlled, and biochemical measurements are made as before. Clinical and radiological checks on the state of the lungs are maintained and physiotherapy again employed from an early stage. Tracheobronchial toilet is carried out regularly and thoroughly but, in the absence of the anticholinesterase drugs, secretions are not often profuse.

Liberal sedation is given to relieve pain as respiratory depression has no adverse effects on the patient and may indeed help him to adjust to mechanical pulmonary ventilation.

When it is decided to discontinue mechanical ventilation it may be useful to give a single dose of anticholinesterase. Frequent biochemical measurements and measurements of minute volume are made to determine that spontaneous ventilation is adequate and further doses of anticholinesterase are given as indicated. If swallowing is also satisfactory the rubber tracheostomy tube is replaced with a silver tube and after a day or so this is also removed and the tracheostomy allowed to heal if satisfactory progress is maintained.

**ADVANTAGES AND DISADVANTAGES OF EACH METHOD**

Both techniques have advantages and disadvantages. If the patient can manage to breathe adequately and to clear his secretions without the need for a tracheostomy or ventilator this is ideal provided the advantages are not bought at too high a cost, and few anaesthetists would unnecessarily inflict a tracheostomy on their patients.

Sometimes, however, spontaneous ventilation without a tracheostomy may only be maintained by giving high doses of anticholinesterase and low doses of analgesics. The first of these—
high dose of the anticholinesterase—carries the risk of a cholinergic crisis which may cause respiratory failure as surely as the disease itself. In addition the profuse bronchial secretions have to be coughed up and this is difficult and painful for the patient following a median sternotomy. If analgesics are held to a minimum the patient suffers considerably, while if they are given too liberally the ability to breathe and cough may be dangerously impaired. Finally, if recourse is necessary to a tracheostomy and intermittent positive pressure ventilation the patient by this time often has a partial lung collapse and infection and has to be rescued from a fairly critical state.

When elective tracheostomy and intermittent positive pressure ventilation are undertaken at the beginning of the recovery period an adequate respiratory exchange can be assured and analgesics can be freely given to relieve pain. The avoidance of anticholinesterase drugs reduces the volume of troublesome secretions which in any event are easily accessible to suction. There is no danger of a cholinergic crisis and the patient may be more responsive to anticholinesterase drugs if they are necessary at a later stage (Randt, 1953). Against this must be set the risk of infection following tracheostomy and the potential disturbances to the circulation of assisted ventilation. With a good triggered ventilator and careful technique both these risks are minimal.

Selection of technique.

The choice of method to be employed in the immediate postoperative care of the myasthenic patient will depend on many factors, such as: the patient; the extent and distribution of his disease; the previous technique used by the medical staff and the success they have enjoyed with it; and the availability of facilities for intensive care of the patient with the support from many departments which this involves.

Standard textbooks, including those by Belcher and Grant (1955), Wylie and Churchill-Davidson (1960), and Mushin (1963), recommend that spontaneous ventilation be restored and a tracheostomy and intermittent positive pressure ventilation used only when necessitated by the first signs of respiratory failure. Colleagues (Crawford and Wishart, personal communication, 1964) have used this technique with good results. Osserman (1958), and Kree and associates (1960), on the other hand, recommend routine tracheostomy after thymectomy in myasthenics and the latter authors, in addition, assist ventilation postoperatively, a technique commended by Foldes and McNall (1962) and Schwab and associates (1964).

In the event much must depend on the circumstances of each patient and the distribution of the disease as between muscle groups. In patients in whom the respiratory muscles are spared and only the peripheral muscles are overtly affected, it would seem entirely reasonable to allow them to resume spontaneous respiration and to sedate them fairly freely.

In patients in whom the respiratory muscles are mildly affected, possibly along with the peripheral muscles, or in whom mild dysphagia from involvement of the bulbar muscles is present, the initial choice of spontaneous or assisted ventilation may depend on the preference and experience of the anaesthetist and the facilities at his disposal.

When the patient has had severe impairment of swallowing or a history of an episode of respiratory failure as a result of his disease then tracheostomy and intermittent positive pressure ventilation from the beginning should be the treatment of choice.

Whichever method is employed the patient should be nursed in the recovery room or intensive care unit where trained staff are always at hand to detect any deterioration in his condition. This is perhaps obvious in the case of a patient who is receiving mechanical ventilation but is no less important in the patient undergoing a trial of spontaneous ventilation.

CASE REPORTS

The management of two cases treated recently, one by each method is described to illustrate the features discussed.

CASE 1.

J.M. was a 39-year-old porter with myasthenia gravis of 6 months duration involving the extraocular muscles, particularly the eyelids, and all four limbs. There had never been any weakness of the respiratory or pharyngeal muscles. He was taking 1440 mg pyridostigmine daily and also ephedrine 30 mg 1.d.s.

Pre-operative preparation. The dose of pyridostigmine (180 mg), due just before operation, was omitted and atropine 0.6 mg was given 1 hour pre-operatively.
**TABLE I**

Blood gas analyses (micro-Astrup) and ventilation measurements from case 1.

<table>
<thead>
<tr>
<th>Day and time</th>
<th>pH</th>
<th>Pco₂ (mm Hg)</th>
<th>Stand. bicarb. (m.equiv/L)</th>
<th>Base excess (m.equiv/L)</th>
<th>Buffer base (m.equiv/L)</th>
<th>Frequency (b.p.m.)</th>
<th>Minute volume (l./min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st 13.25 hrs.</td>
<td>7.34</td>
<td>49</td>
<td>23.5</td>
<td>-1</td>
<td>50.5</td>
<td>19</td>
<td>9.9</td>
</tr>
<tr>
<td>14.30 hrs.</td>
<td>7.38</td>
<td>49</td>
<td>23.0</td>
<td>-1</td>
<td>49</td>
<td>23</td>
<td>5.95</td>
</tr>
<tr>
<td>22.00 hrs.</td>
<td>7.40</td>
<td>41</td>
<td>24.5</td>
<td>+1</td>
<td>52</td>
<td>25</td>
<td>10.9</td>
</tr>
<tr>
<td>2nd 11.00 hrs.</td>
<td>7.41</td>
<td>30</td>
<td>20</td>
<td>-4</td>
<td>42</td>
<td>22</td>
<td>13.4</td>
</tr>
<tr>
<td>14.00 hrs.</td>
<td>7.42</td>
<td>34</td>
<td>22</td>
<td>-2</td>
<td>44</td>
<td>22</td>
<td>12.4</td>
</tr>
<tr>
<td>3rd 11.00 hrs.</td>
<td>7.42</td>
<td>36</td>
<td>24</td>
<td>0</td>
<td>49</td>
<td>22</td>
<td>12.8</td>
</tr>
</tbody>
</table>

Anaesthetic technique. Anaesthesia was induced with nitrous oxide and oxygen with halothane and maintained with nitrous oxide and oxygen with halothane (V.O.C.), ventilation being controlled and the systolic blood pressure remaining steady at 120 mm Hg. The trachea was intubated with a No. 11 cuffed endotracheal tube. At operation (median sternotomy incision) a large, multilobular, golden yellow thymus gland was displayed. This was dissected off the great vessels and removed. The right pleural sac was opened and so this was drained; the anterior mediastinum was also drained. Just before the last skin suture was inserted spontaneous ventilation was re-established without difficulty, after an anaesthetic lasting 2 hours 20 minutes. Within a few minutes the patient awoke and at this point his tidal volume was measured at between 1 and 1.5 l. Following endobronchial suction, the endotracheal tube was removed and he was transferred to the Intensive Care Unit.

Postoperative care. Shortly after admission to this unit, he was in considerable pain and pethidine 50 mg in divided doses was given intravenously. Adequate spontaneous respiration continued, the respiratory rate and the tidal volume being measured every 30 minutes, and blood gases measured at 1, 2 and 9½ hours after operation (see table I).

There was no muscle weakness, despite the withholding of all pyridostigmine. Morphine 10 mg was given intramuscularly 6-hourly to control the pain of the sternotomy wound.

On the second postoperative day, he remained well, both ventilation measurements and blood gas analyses being satisfactory (table I). The chest drains were removed, and the chest radiograph checked. By the afternoon of that day, however, some weakness of the left eyelid and the left forearm developed, and pyridostigmine 60 mg i.d. was commenced.

As ventilation remained satisfactory, and the muscular weakness appeared to be under control with the pyridostigmine, he was returned to the ward on the third postoperative day.

**CASE 2.**

E.McG. was a 38-year-old housewife with myasthenia gravis of 2 years duration involving the facial, extraocular, pharyngeal, and respiratory muscles. Prior to operation she was taking 15 tablets (900 mg) of pyridostigmine per day. She had had two previous episodes of acute respiratory failure following "colds" 6 months and 1 month prior to coming to surgery. Both these episodes required ventilator therapy via an endotracheal tube in the Intensive Care Unit, Glasgow Royal Infirmary.

Anaesthetic technique. Anaesthesia was induced with thiopentone 100 mg and maintained with nitrous oxide and oxygen with halothane (V.O.C.), ventilation being controlled, and the systolic blood pressure remaining steady at 130 mm Hg. The larynx and trachea were sprayed with lignocaine 4 per cent and a No. 9 cuffed endotracheal tube passed. At operation (median sternotomy incision) a long narrow thymus gland (5 X 1 in.) was displayed (fig. 1). This was removed in its entirety. The pleura was intact but a waterseal drain was inserted in the anterior medias-
TABLE II  
Blood gas analyses and ventilation measurements from case 2.

<table>
<thead>
<tr>
<th>Day and time</th>
<th>pH</th>
<th>Pco₂ (mm Hg)</th>
<th>Stand bicarb. (m.equiv/l.)</th>
<th>Base excess (m.equiv/l.)</th>
<th>Buffer base (m.equiv/l.)</th>
<th>On vent. Frequency (b.p.m.)</th>
<th>Tidal volume m/s</th>
<th>Press. (cm. H₂O)</th>
<th>Off vent. Frequency (b.p.m.)</th>
<th>Minute volume (l./min.)</th>
<th>Comments</th>
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<tr>
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<td>20</td>
<td>400</td>
<td>12</td>
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<td></td>
<td></td>
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<tr>
<td>2nd 10.30 hrs.</td>
<td>7.54</td>
<td>24.5</td>
<td>22</td>
<td>+1.5</td>
<td>48.5</td>
<td>20</td>
<td>450</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd 10.30 hrs.</td>
<td>7.53</td>
<td>22</td>
<td>21.5</td>
<td>−2</td>
<td>45</td>
<td>20</td>
<td>450</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th 09.40 hrs.</td>
<td>7.45</td>
<td>32</td>
<td>23</td>
<td>+0.5</td>
<td>48</td>
<td>20</td>
<td>500</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.20 hrs.</td>
<td>7.46</td>
<td>31</td>
<td>23.3</td>
<td>+0.5</td>
<td>48</td>
<td>20</td>
<td>500</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.45 hrs.</td>
<td>7.41</td>
<td>36</td>
<td>23</td>
<td>0</td>
<td>46</td>
<td>20</td>
<td>500</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th 11.00 hrs.</td>
<td>7.44</td>
<td>35</td>
<td>24</td>
<td>+2</td>
<td>48</td>
<td>20</td>
<td>500</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th 12.30 hrs.</td>
<td>7.41</td>
<td>45</td>
<td>26.5</td>
<td>+5</td>
<td>52</td>
<td>20</td>
<td>500</td>
<td>16</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7th</td>
<td>7.44</td>
<td>40</td>
<td>26</td>
<td>+4</td>
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<td>20</td>
<td>500</td>
<td>16</td>
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</tr>
<tr>
<td>8th</td>
<td>7.44</td>
<td>38</td>
<td>25.3</td>
<td>+3</td>
<td>50</td>
<td>20</td>
<td>500</td>
<td>16</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

50% air-oxygen mixture

Femoral puncture; oxygen saturation 99 per cent

100 per cent air

Before weaning

32 9.18 Off ventilator

32 10.9 Off ventilator

Metal tracheostomy tube inserted

Tracheostomy tube removed

Pyridostigmine started
tinum and the thorax closed. Tracheostomy was performed, a No. 10 Rusch tracheostomy tube inserted, and intermittent positive pressure ventilation maintained with air while the patient was transferred to the Intensive Care Unit.

Postoperative care. Intermittent positive pressure ventilation with a 50 per cent oxygen and air mixture was instituted using a Barnet ventilator. The patient regained consciousness shortly after admission to the Unit and complained of pain which was relieved by pethidine 50 mg given intravenously in divided doses.

Mechanical ventilation was instituted without any difficulty and liberal doses of pethidine were given to relieve pain. There were no obvious signs of muscular weakness, and she could breathe spontaneously during the tracheobronchial toilet.

On the second postoperative day the supplementary oxygen was discontinued, and on spontaneous respiration the patient's minute volume was 7.5 l./min (tidal volume 250 ml, and respiratory rate 33 b.p.m.).

At 9 a.m. on the third postoperative day she was given a single dose of pyridostigmine 90 mg via the intragastric tube and at 10 a.m. the ventilator therapy was discontinued (for blood gas monitoring see table II). The following day the cuffed tracheostomy tube was replaced by a Chevalier Jackson metal tube, which was removed the next day and the tracheostome covered by a gauze pad.

On the sixth postoperative day, because she had developed dysphagia and some weakness of the eyelids was noted, she was started on pyridostigmine 60 mg b.d. She was discharged from the Intensive Care Unit on the tenth postoperative day.

CONCLUSIONS

We feel that division of myasthenic patients into groups according to involvement of respiratory, pharyngeal or limb and eye muscles suggests the appropriate postoperative régime for each patient.

In the group who have a history of respiratory embarrassment or dysphagia, elective tracheostomy and intermittent positive pressure ventilation is the treatment of choice. When ventilation is assisted, anticholinesterase drugs are unnecessary for the first few days.

When only the eye and limb muscles are overtly involved spontaneous ventilation is initially permitted and, as the patient is resting in bed, anticholinesterase drugs are again discontinued for a few days.

It is in the third group, in which there is a history of mild involvement of the respiratory or pharyngeal muscles, that difficulty may arise in the selection of the correct régime. The authors agree with Schwab and his colleagues (1964) that elective tracheostomy, with intermittent positive pressure ventilation if indicated by blood gas analysis, is also the treatment of choice in these patients. By avoiding anticholinesterase drugs during the first few days, the risk of cholinergic crisis is avoided and a better effect may be expected if and when they are resumed (Randt, 1953). Morphine, the effect of which is potentiated by anticholinesterase drugs (Slaughter, 1950) and other analgesics, may also be more freely given.

The benefits obtained by nursing all such cases in an intensive care unit dealing with respiratory cases are obvious, irrespective of the technique of postoperative management.

ACKNOWLEDGMENTS

Both patients described were cared for postoperatively in the Respiratory Emergency Unit in Glasgow Royal Infirmary. To the nursing staff and the anaesthetists who provided round-the-clock supervision we—and the patients—are grateful.

Case 1 was admitted under the care of Dr. Alex Imrie, thymectomy being performed by Professor W. A. Mackey. Case 2 was admitted under the care of Dr. Eric Oastler, thymectomy being performed by Mr. J. D. Thomson.

We are grateful to Mr. Kelly of the Department of Medical Illustration, Glasgow Royal Infirmary, for the illustration.

REFERENCES


LES SOINS POST-OPÉRATOIRES IMMÉDIATS APRES LA THYMECTOMIE CHEZ LE MYASTHÉNIQUE

SOMMAIRE

On discute les problèmes qui s'élevrent chez le myasthénique dans les suites opératoires immédiates après une thymectomie. On considère les indications et les avantages de la respiration spontanée, de la trachéostomie élective et de la ventilation en pression positive intermittente, et on souligne le bénéfice à traiter ces cas dans un service de soins attentifs. On considère qu'un essai de respiration spontanée n'est indiqué que chez les malades où la maladie est limitée à l'atteinte manifeste des muscles des membres et des yeux. Les drogues anticholinestérase peuvent être omises les quelques premiers jours en utilisant les régimes qui sont suggérés, ce dont on souligne les avantages. On décrit en détail le traitement de deux cas.

BRITISH JOURNAL OF ANAESTHESIA

DIE UNMITTELBAR POSTOPERATIVE VERSORGUNG VON MYASTHENISHEN PATIENTEN NACH THYMUSENTFERNUNG

ZUSAMMENFASSUNG


BOOK REVIEW


The present reviewer had the interest of reviewing the first volume of this series and would like to record at once the improvement evident in the second. The volume is made up of the summaries of current concepts and journal articles prepared for a trainee Review and Discussion Seminar, at the Anaesthesia Department of the Charity Hospital of Louisiana. This form of mutual discussion of prepared topics by staff and students is perhaps the most stimulating and useful method of postgraduate instruction. The writer has had experience of it for over ten years and can testify that the effect on the staff of a department is extremely beneficial. Speculative thought is provoked and, not infrequently, leads to an investigation of problems which are seen to await solution. Perhaps even more important, the discussion reveals those dark corners which too often, as a result of voluntary or involuntary cerebral blocking, cloud the full understanding of a topic or problem. Further, the discussions lead to a greater mutual sympathy between students and teachers and to removal of any fear that the former are being spoken down to or that the latter are protected from self-revelation by their eminence. Confidence is engendered and friendliness cultivated to mutual benefit.

The deficiencies of the previous volume are certainly not evident in this. The references at the end of each summary are well displayed and include the titles of articles. It is true that the depth to which topics are explored varies, but every incentive is given to further reading, and directions in which this should take place are indicated in the paragraphs. The topics are extraordinarily interesting and modern. There are forty-five of them in all and they range from the apparent simplicities of such things as airway resistance and the Ayre's T-piece, through the complexities of modern methods of blood gas analysis and electrode systems, to a review of statistics which, by the way, are not quite so simply or clearly laid out as might be expected. On the way, are taken in various considerations regarding endocrinology, the control of cerebral tension, reflex activity in the aged and under anaesthesia, and such topical backwaters as electrical anaesthesia and the effects of mongolism on anaesthesia. This list is an inadequate summary of the broad spectrum of topics covered and one would consider that any teacher planning this sort of discussion group would be well to arm himself with this volume. It might, to those who are not in such an academic atmosphere, be quite a reasonable substitute for a postgraduate revision course.

Cecil Gray