ANAESTHESIA FOR GLOMECTOMY IN THE ASTHMATIC PATIENT*

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THE ASTHMATIC PATIENT has always been a major problem for the anaesthetist when general anaesthesia is required. Many reports over the years of the benefits of various agents and techniques have done little to improve the situation. The high incidence of respiratory¹ and circulatory² complications reported both during and after anaesthesia and surgery indicates how formidable a problem the asthmatic can be. The anaesthetic difficulties during the procedure are directly related to the bronchospasm and excess secretions which result in hypoxia and hypercapnia, and these in turn are the basis for most of the cardiac difficulties so often encountered. Cardiovascular problems diminish in the postoperative period but respiratory problems² often increase as do surgical problems, both being related to the excess secretion and the inability to clear the airway because of bronchospasm and surgical pain. The muscle straining associated with the laboured respiration and coughing often produces adverse effects on wound repair.

Over the years every agent and technique has been tried in this situation but usually a return is made to ether. Ether has been traditionally recommended as a form of therapy for asthma. However, many anaesthetists believe ether can, because of its irritating properties, precipitate bronchospasm in the asthmatic. When an adequate depth of anaesthesia has been achieved most asthmatics do well with ether, even those in a state of bronchospasm are often relieved. This relief has been ascribed to the increased levels of circulating catecholamines and corticosteroids which accompany deep ether anaesthesia, but this is an unlikely explanation. Thiopentone and cyclopropane have been condemned for use in the asthmatic because of their apparent parasympathomimetic properties. In spite of this many studies have shown equally good results with these agents, but Gold¹ reported a high incidence of complications when these two agents were combined. In the past few years halothane has been used extensively in asthmatics and uniformly good results have been reported with this agent, both for the prevention of respiratory complications and for treating them should they occur.^{1,3} Why this should be so has not been explained. Increased levels of catecholamines and steroids could not be of importance with this agent. Regional anaesthesia is relatively free of complications as long as the operative site is extraperitoneal, but offers no protection with intraperitoneal surgery.¹

We believe that most anaesthetists would agree with Schnider and Papper³ that the commonest cause of respiratory complications during anaesthesia in the asthmatic is the irritation of the respiratory tract by agents or instrumentation. The avoidance of airways and endotracheal tubes until an adequate level of

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anaesthesia has been achieved would appear to be the wisest course if the anaesthetist must use an airway or endotracheal tube, otherwise the presence of an endotracheal tube may do more harm than good. We do not believe that there is any place for a barbiturate, relaxant, crash intubation type of induction in the unprepared asthmatic patient, although recognizing that it is widely used.

Many surgeons believe that the asthmatic is more liable to convulsive and circulatory collapse reactions with local anaesthetic agents, and therefore request general anaesthesia even when the operation can be done quite easily and comfortably for the patient with a simple infiltration or block technique. This impression we believe is based in large part on serious cardiac reactions which have occurred in the past with topical agents, usually potent drugs, given in overdose for bronchoscopy in the asthmatic patient. These reactions were in large part responsible for the change to an almost routine use of general anaesthesia for bronchoscopy in this institution. We believe that many respiratory problems in the asthmatic patient could be prevented by the use of local anaesthetic techniques and, where feasible, this is the method of choice. Unfortunately local anaesthesia requires a type of surgical technique which is rarely found today, and is therefore unsatisfactory except for the most superficial type of surgery, requiring little if any muscle retraction.

It has been our belief for several years that the most important factor in providing safe anaesthesia is adequate preoperative preparation for the asthmatic patient—far more important we believe than anaesthetic agents and techniques. The advent of aerosol liquefying agents and bronchodilators administered by intermittent positive pressure inhalation apparatus and combined when necessary with postural drainage and physiotherapy will often produce dramatic improvement. Such therapy needs to be administered correctly by trained therapists. Days or even weeks of such therapy may be advisable where time permits. There are those intractable cases in whom such inhalation therapy can only achieve limited improvement and it fails to bring the patient's ventilatory function to normal or near normal levels. In these cases we believe that steroids are indicated and should be used when inhalation methods fail to achieve the desired unobstructed tracheobronchial tree. It is recognized now that steroids can be used safely as pre- and post-operative therapy for many types of respiratory problems without deleterious systemic effects and providing almost uniformly good results.⁴ In most cases, except the severe intractable ones, steroids need only be given for 24–48 hours preoperatively and for three to five days postoperatively. It has been shown⁵ that if cortisone is not given for longer than a week there is little if any depression of adrenal cortical function and there is no need to wean the patient off the drug, which may be discontinued abruptly. The use of the newer synthetic preparations will suppress adrenal response when given for as short a period as 4–5 days. Weaning often becomes necessary when using these preparations. The preparation of the asthmatic patient for emergency surgery may require the use of massive intravenous doses of steroids, intravenous or rectal aminophylline, and intravenous or aerosol isoproterenol. The establishment of adequate anaesthesia or even deep anaesthesia will be necessary if endotracheal intubation is required, in order that one may avoid precipitating a

bronchospasm from tracheal irritation or aggravating an already existing bronchospastic state

It was decided that a group of severe intractable asthmatics considered to be medical failures would be ideal for determining the hazards of anaesthesia in such patients and the value of good preoperative preparation of these, the worst type of asthmatics. It was therefore decided to study those patients subjected to glomectomy (carotid body excision) as these were all severe asthmatics, the majority of whom had required intermittent steroid therapy in the past, or were currently receiving steroid therapy. All had received intensive investigation and inhalation and other therapy before surgery.

Glomectomy or excision of the carotid body for the treatment of asthma was first introduced by Nakayama⁶ and on this continent by Overholt⁸. In the past many surgical procedures involving the autonomic nervous system have been used and all have been discarded. Superior cervical ganglionectomy and vagotomy or both combined have been tried, but have not survived. The rationale of glomectomy as stated by Nakayama⁶ and Overholt⁸ is that the carotid body involves both parasympathetic and sympathetic nerve elements and, because it is sensitive to changes in oxygen, carbon dioxide, and pH, thereby influencing respiration, it must, because of its extensive connections between the parasympathetic and sympathetic nervous systems, influence the tone of bronchial musculature. Overholt⁸ states that removal of one carotid body and its nerve connections interrupts pathways between the pulmonary plexus and mid-brain, which dampens an overactive bronchoconstricting reflex. He further states that the major relief the asthmatic obtains from this operation is the quietening of an oversensitive reflex caused by hypoxia, preventing the development of the vicious cycle which occurs when the asthmatic tries to hyperventilate. Such hyperventilation in the presence of a compromised airway only leads to further turbulence, decreased tidal flow, and decreased alveolar ventilation, aggravating the fault already present. Overholt^{8,9} claims that four out of five patients benefitted from the procedure. Some of those in whom wheezing and rales persisted still obtained symptomatic relief. If benefit was obtained at one month it was usually maintained for longer periods, with a gradual diminution in relief in those followed for three years. Nakayama⁶, on the other hand, reports 81.3 per cent of 3914 cases cured or improved, with 58 per cent still having good results after 5 years. He also states that he frequently found an increase in vital capacity and there was little if any increase after bilateral glomectomy. Nakayama, writing in 1963, says that bilateral removal is contraindicated as this procedure causes severe hypoxia, even in the cases who failed to benefit from unilateral removal.⁷ He further claims little change in normotensive blood pressure, but in the hypertensive there is a significant drop in blood pressure and in hypotensives the blood pressure has been elevated.⁶ He also claims to have observed an increase in diaphragmatic movement and in arterial oxygen saturation.

The Pulmonary Function and Respiratory Therapy Unit of this hospital decided to study patients undergoing this operation by the use of vigorous preoperative preparation and pre- and post-operative pulmonary function tests. When a longer follow-up period has passed, this work will be reported in detail.

TABLE I

Number of patients studied—45	
31 Male age range 16–65 years	Average 48 2
14 Female age range 16–71 years	
Duration of symptoms 1–45 years	Average 15 3
Preoperative pulmonary complications	
Asthma	45 patients
Asthma plus emphysema	12
Asthma plus chronic bronchitis	2
Asthma plus pulmonary fibrosis	1
Asthma plus previous lobectomy	1
Surgery performed	
Unilateral glomectomy	30 patients
Bilateral glomectomy	4
Controls	11
Controls plus subsequent unilateral glomectomy	2

by this unit. Our primary interest at this time was the value of adequate preoperative therapy in these severe asthmatics as a protective preoperative measure against the complications which are reported to occur so frequently during anaesthesia in asthmatic patients. As these were all severe cases considered to be medical failures, we expected a high incidence of complications. The anaesthetics were administered by several anaesthetists and it will be noted from Table II that no special general anaesthetic procedure was adopted. Most of the anaesthetists carried out the usual barbiturate relaxant endotracheal induction. Halothane was used in 54 per cent of cases where general anaesthesia was used, signifying the belief that most of our anaesthetists have that this non-irritating potent agent is desirable in the asthmatic. Early in this study the surgeons used local infiltration analgesia in four cases but this was unsatisfactory from their point of view and from that of their patients. We believe this dissatisfaction was the result of inadequate sedation and excessive muscle retraction. Superficial and deep cervical plexus block administered by the anaesthetist was used in six cases with satisfactory results until a toxic reaction occurred which ended with cardiac collapse. This tragedy unfortunately reconfirmed the surgeons' belief in the hazards of the use of local agents in the asthmatic and in the greater safety of general anaesthesia. Following this case all further operations were carried out under a general anaesthetic technique.

TABLE II

Anaesthetic	Number	Orotrach	Oropharyng	Complications	
				During operation	Immediate postop
Local infiltration (lignocaine)	4				1 bronchospasm
Cervical block (lignocaine)	6			1 Cardiac arrest, resuscitated	Empyema died at 5 weeks
Halothane	24	22	2	1 Hypotension	
Ether	10	10		2 Bronchospasm	
Methoxyflurane	6	6			
Thiopent-N ₂ O	1				1 Bronchospasm
Total	51	38	2	4	2

Patients 45—6 patients had bilateral operations

This case will be reported briefly because it is of interest that cardiac collapse occurred and resuscitation was successful. This is not common according to the findings of Converse,² who also reports a 20-fold increase in the incidence of cardiac arrest in the asthmatic as compared to the non-asthmatic.

Case No 207698

This patient was a 56-year-old white male with a long history of severe chronic asthma with marked obstructive defect. The patient was on prednisolone therapy 5 mg q.i.d. On July 9, 1962, he was prepared for glomectomy under cervical plexus block, which the patient requested as he was afraid to go to sleep. Block was carried out using 27 ml of 1.5 per cent lignocaine with epinephrine 1:200,000. Immediately after completion of the block the patient developed signs of central nervous system irritability and impending convulsion. The anaesthetist administered approximately 200 mg of thiopentone, which was immediately followed by bronchospasm, and ventilation was found to be impossible. Succinylcholine 60 mg was given intravenously and the patient was intubated at once. Inflation was still impossible because of bronchospasm, and cardiac arrest was diagnosed almost immediately thereafter. External cardiac compression was unsatisfactory, therefore a left thoractomy was performed and the heart was found to be in asystole. Massage immediately restored an adequate beat, anaesthesia was deepened with ether, and the patient made an eventful recovery. Postoperatively the patient's condition gradually deteriorated as a result of an empyema which developed, and on August 24 he died. Following the original glomectomy on July 9 the patient experienced a short period of improvement as far as his chest symptoms were concerned, but his dyspnoea rapidly recurred and became very severe for the duration of his life.

It is believed that in this case the dose of lignocaine was excessive for the site of the block and that there was no need to postulate any hypersensitivity of the asthmatic to explain the presence of a convulsive reaction to lignocaine. We believe that the cardiac arrest was the result of asphyxia which, combined with the presence of succinylcholine and endotracheal stimulation, precipitated a reflex vagal asystole. If the cardiac arrest had been the direct result of the action of the local agent on the heart, it is unlikely that resuscitation would have been as rapid as it was.

As is shown in Table II there were few respiratory or circulatory problems associated with general anaesthesia in the 41 operations conducted under this form of anaesthesia. None were severe. The series is obviously too small to make any statements concerning the advantages of one agent or technique over another. From our own past experience and the reported experience of others¹⁻⁴ it would seem reasonable to attribute the lack of anaesthetic complications to the extensive use of steroids and aerosol therapy in the preoperative preparation. Even the use of a crash induction intubation technique was relatively innocuous in these well-prepared patients, although the authors do not recommend such a technique in the asthmatic patient with signs and symptoms of obstructive pulmonary disease.

Although a long follow-up period is not available as yet, data for the period up to six months postoperative would suggest there is little if any improvement in the pulmonary condition. Several patients, as reported by others,⁶⁻⁸ appear to have experienced considerable symptomatic improvement as is shown in Table III.

TABLE III
SUBJECTIVE ASSESSMENT OF RESULTS OF GLOMECTOMY

Time postoperative	Number evaluated	Improved	Unchanged	Worse
1 week	34	24 (73 5%)	10 (28 5%)	0
1 month	34	27 (89 5%)	7 (10 5%)	0
6 months	26	5 (19 2%)	21 (80 8%)	0

The control operations consisted of three operations in which the incision was only carried through the fascia, and no glomectomy was attempted, and eight cases in which the pathologist was unable to identify the carotid body, we therefore concluded that glomectomy had not been performed as the surgeon had intended. Other workers have not reported pathological study to indicate whether a glomectomy was actually performed or not. These results are shown in Table IV. In two of the control patients glomectomy was performed on the other side with no improvement in the patients' subjective assessment. Two of the most impressive cases of improvement were in patients who underwent the sham operation only. There is obviously a need for a large series involving this type of control.

TABLE IV
SUBJECTIVE ASSESSMENT OF CONTROLS

Time postoperative	Number evaluated	Improved	Unchanged	Worse
1 week	11	6 (54 5%)	3 (27 3%)	2 (18 2%)
4 weeks	11	5 (45 5%)	4 (36 3%)	2 (1 deceased) (18 2%)
6 months	11	5 (45 5%)	4 (36 3%)	2 (18 2%)

The results tend to show improvement in the immediate postoperative period, then rapidly become worse with time. Others report the same finding. These patients were assessed by interview, questionnaire, and studies were done to evaluate pulmonary function before and after surgery. Vital capacity, 0.5-second vital capacity, and maximum expiratory flow rate were measured, as was the response to inhaled 8 and 10 per cent concentrations of carbon dioxide. Results at this stage in the study do not reveal any significant changes in these tests following operation. After a larger series and a longer period of assessment, Dr B. Sproule, director of the Respiratory Therapy and Pulmonary Function Unit in this hospital, will report these results in detail.

All groups showed a diminution in response to 8 and 10 per cent carbon dioxide in the preoperative tests and this was not improved by glomectomy. As was also reported by Nakayama,⁷ those patients in this study who underwent bilateral glomectomy, when exposed to an atmosphere containing 8 per cent oxygen, showed no respiratory response, and even became cyanosed before evidence of distress occurred.

Postoperatively, all of these patients still required intensive medical therapy.

TABLE V

Medications	Preoperative		At 6 months postoperative	
Nebulization	45	100%	45	100%
Bronchodilators	39	89%	20	44%
Steroids	29	64%	14	31%

The difference in the number of patients receiving steroids postoperatively as compared with those receiving them preoperatively is due to the fact that many of these patients were given steroids as part of the preoperative preparation for surgery, or because they were so ill on admission to hospital that they required steroid therapy. Most of these patients were admitted for medical therapy for their severe asthmatic condition and not primarily to undergo this operation. We would at this time concur with Schiller, who has stated "that until more experience has been gained a healthy skepticism toward this empirical and unphysiological procedure is advisable."¹⁰

SUMMARY

Results of 51 anaesthetics administered to 45 asthmatic patients undergoing surgery for glomectomy have been presented. Approximately 83 per cent of these patients received general anaesthesia. All patients were under intensive medical therapy preoperatively and 64 per cent were receiving steroids at the time of surgery. No severe respiratory or circulatory complications occurred with general anaesthesia. One cardiac collapse occurred following a convulsive reaction with local anaesthesia. It is concluded that with adequate preoperative preparation with particular attention to the use of steroids and aerosol bronchodilator therapy the severe asthmatic can be anaesthetized with relative safety. Halothane would appear to be a very satisfactory agent for the asthmatic. Glomectomy appears to be of little if any value in the treatment of the asthmatic.

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RÉSUMÉ

Nous avons fait part des résultats de 51 anesthésies données à 45 asthmatiques soumis à la chirurgie pour glomectomie. Environ 83 pour cent de ces malades ont reçu une anesthésie générale. Avant l'opération, tous les sujets recevaient des soins médicaux intensifs et 64 pour cent recevaient des stéroïdes au moment de la chirurgie. A la suite de l'anesthésie générale, nous n'avons pas observé de complications respiratoires ou circulatoires. Après une anesthésie locale, nous avons observé des convulsions suivies d'un collapsus cardiaque. Nous en venons à la conclusion que, si la préparation préopératoire est adéquate, si on

porte une attention spéciale à l'usage des stéroïdes et à celui de la thérapie avec des bronchodilateurs en aérosol, les grands asthmatiques peuvent bénéficier d'une anesthésie relativement inoffensive. L'halothane nous semblerait un agent très satisfaisant pour les asthmatiques. La glomectomie dans le traitement des asthmatiques nous semble avoir peu de valeur, si elle en a.

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