cases demonstrates that cardiac arrest after administration of succinylcholine may occur in patients who have a wide variety of neurologic problems. Care should be taken not only in the cases of patients with burns, massive trauma and paraplegia from spinal-cord injury, but also following brain injury and other central nervous system diseases, particularly those involving muscular paralysis. Cardiac arrest may occur after the use of succinylcholine in immobilized patients with injuries other than central nervous system injuries.

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Pediatric Bronchial Blocking

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Pulmonary resection in pediatric patients is seldom complicated by copious secretions. Preoperative preparation with intermittent positive-pressure breathing, postural drainage, and antibiotics have minimized the incidence of life-threatening secretions. The rare pediatric patient who has localized copious secretions presents a difficult and dangerous anesthetic situation.

Patients undergoing pulmonary resection for bronchiectasis, pulmonary abscess, hemorrhage, bronchopleural fistula, or hydatid cyst may be managed in one or a combination of three ways to prevent inundation of the good lung with secretions from the diseased lung. The patient may be positioned in a manner which facilitates drainage to the exterior, rather than into the good lung. This generally involves a prone, head-down position. Although this method is reasonably effective in controlling secretions, it has disadvantages from the surgical viewpoint. The exposure afforded by a posterior thoracotomy is less than optimal, and surgeons are reluctant to attempt pulmonary resection with the posterior approach. Double-lumen tubes of the Carlens type [1] offer a satisfactory means of controlling secretions, and allow the use of a standard surgical approach, but they are not satisfactory for pediatric patients because of the size limitations imposed by the airway. A double-lumen tube in pediatric sizes would create excessive resistance to respiration and provide insufficient space for suctioning. Bronchial blockers, which offer a satisfactory means of controlling localized secretions without compromising the surgical approach or unduly restricting the airway,[2] have also been considered unsatisfactory for small pediatric patients because of the limitations imposed by the available methods and mate-

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rials.[3] The Magill bronchial blocker, for example, is too large to use in patients less than 8 years old.[4] It is also recommended that bronchial blockers be inserted under direct vision, which in the pediatric patient becomes technically difficult.

This report describes a simple, effective method for the management of thoracotomy in the pediatric patient when secretions may be life-threatening.

Report of a Case

A year before admission to our hospital, a 3½-year-old girl had been admitted to another institution, where she had been treated with penicillin for left lower lobar pneumonia due to *Staphylococcus aureus*. Four months later she was admitted to Harbor General Hospital for evaluation of persistent left upper and lower lobar pneumonia. Bronchoscopy revealed purulent secretions from the left lower lobe. Bronchography showed poor distal filling of the left lower lobe and ectasia of the distal bronchus. The patient was given a ten-week course of antibiotic therapy on an outpatient basis, after which she was readmitted for evaluation and possible pulmonary resection. Elective bronchoscopy with the patients under general anesthesia was attempted. Upon insertion of the bronchoscope, massive purulent secretions flooded the trachea, completely obscuring vision and preventing ventilation via the bronchoscope. The bronchoscope was removed and a 20F endotracheal tube inserted. Large quantities of purulent secretions were suctioned from the endotracheal tube before the patient could be ventilated effectively. Further attempts at bronchoscopy were abandoned.

The patient was given an 18-day course of intermittent positive-pressure breathing and postural drainage, which was only partially successful in reducing secretions. She was then scheduled for elective thoracotomy for left lower lobectomy.

The patient was 38 inches tall and weighed 37 pounds. Preoperative hematocrit was 38 per cent. Many rhonchi and coarse rales were heard over the left chest, most pronounced over the lower lobe. An hour prior to induction of anesthesia the patient was premedicated with meperidine, 25 mg, promethazine, 10 mg, and atropine, 0.3 mg. Anesthesia, induced by mask, consisted of halothane and oxygen in a nonrebreathing system, incorporating a Stephen Slater valve.

A #4 Fogarty embolectomy catheter ‡ was used as a bronchial blocker. A small curve was placed in the distal end. When the patient was anesthetized, the head was rotated slightly to the right. Laryngoscopy was performed and the catheter inserted. The curve was directed toward the left, which enabled the catheter to be passed down the left main-stem bronchus. The laryngoscope was removed and the patient ventilated by mask for 30 seconds. Laryngoscopy was repeated, a 20F endotracheal tube inserted and connected to the anesthesia circuit. The stylet was removed from the Fogarty catheter and the balloon inflated with 0.5 ml of air. During auscultation over the left lower lobe, the Fogarty catheter was gradually withdrawn until breath sounds were no longer heard. The catheter was taped in place and the child placed in the lateral position.

Thoracotomy proceeded uneventfully. With the chest open, and prior to resection, venous blood values were: pH 7.16, P_{CO_2} 68 mm Hg, P_{O_2} 54 mm Hg, standard bicarbonate 24 mEq/l, base excess −5.5. After the left lower lobe had been resected, the Fogarty catheter was deflated and removed. At the conclusion of the case, the lungs were clear to auscultation, and the postoperative chest x-ray was clear.

The patient's postoperative course was uneventful except for mild atelectasis on the second postoperative day, which responded to two periods of nasotracheal suction and intermittent positive-pressure breathing. She was discharged to clinic follow-up on the tenth postoperative day.

Discussion

A method for the effective control of copious secretions in the small pediatric patient undergoing pulmonary resection has been described. Failure to control secretions in these patients appreciably increases the mortality and morbidity for the procedure. Spread of secretions can interfere with adequate ventilation by occlusion of air passages. A further complication is the spread of secretions to healthy lung tissue, with the development of atelectasis or lung abscess.

Standard bronchial blockers are not satisfactory for the small pediatric patient because of size limitations. The Fogarty arterial embolectomy catheter[5] is effective as a bronchial blocker in such patients. Its small diameter, soft tip and sturdy balloon make it ideally suited for the purpose. It is not necessary to insert the catheter via a bronchoscope. By turning the patient's head to the opposite side and placing a small curve at the tip, the catheter may easily be directed into either bronchus, Proper placement of the balloon may then be determined by auscultation.

Secretions were effectively controlled in the case reported. Venous blood was analyzed

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during the period of greatest ventilatory compromise. Oxygenation remained adequate. The acidosis which developed was undesirable, although well tolerated. In future similar cases, vigorous hyperventilation during the period of greatest ventilatory compromise is recommended.

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Anesthetic Management of an Incompletely Controlled Hyperthyroid Patient for Thyroidectomy

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Modern therapy with antithyroid drugs is so effective that the anesthesiologist is seldom confronted with an uncontrolled thyrotoxic patient. Although thyroid storm rarely occurs in well controlled patients, it is likely to occur in poorly controlled patients.[1] Many of its manifestations resemble those of adrenergic stimulation: tremor, anxiety, tachycardia, arrhythmias, increased cardiac output, increased metabolic rate and increased temperature. Interaction of at least two, and possibly three, hormonal systems is necessary to produce these manifestations.[2] If either the adrenergic or the thyroid system is blocked, the hemodynamic and metabolic signs and symptoms of thyrotoxicosis can be eliminated or reduced.

Spinal anesthesia,[3-5] reserpine,[6] guanethidine,[7,8] and ganglionic blockade[9] have been suggested to interrupt the adrenergic system and thereby control the peripheral manifestations of hyperthyroidism or thyroid storm. Sympatholytic drugs may alleviate the tachycardia, arrhythmias, tremor, restlessness and heat intolerance in hyperthyroidism. However, thyroid function itself is unaffected, with sustained increases in protein-bound iodine and radioactive iodine uptake.[10] Cardiac output and oxygen consumption are decreased somewhat by sympathetic blockade but no change in weight or serum cholesterol occurs.

We recently were involved in the anesthetic management of a patient allergic to both methimazole and propylthiouracil who required thyroidectomy at a time when she was hyperthyroid. We used alpha- and beta-blocking drugs to prevent thyroid storm. The patients course and our rationale for this management are presented.

REPORT OF A CASE

A 14-year-old Caucasian girl known to have had hyperthyroidism for seven months developed a generalized pruritic erythematous rash, first in response to methimazole and then in response to propylthiouracil, in the course of her therapy. These drugs were discontinued and she was evaluated at Yale–New Haven Hospital on February 3, 1970. Symptoms included easy fatigability, tremulousness, emotional difficulties, heat intolerance and weight loss. The patient denied diarrhea or menstrual irregularities.

Physical examination showed a thin, anxious, girl with tachycardia of 132 beats/min. She had bilateral exophthalmos with bilateral lid lag. The thyroid was diffusely enlarged, soft, and nontender, with bilateral bruits. Deep tendon reflexes in the lower extremities were hyperactive. Serum protein-bound iodine (PBI) was 19.0 μg/100 ml,‡ with a T_3 uptake of 70 per cent.§

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‡ Normal value: 4.0–8.0 μg/100 ml.
§ Normal value: 93 per cent uptake or less is compatible with hyperthyroidism.