The Role of Allergen Immunotherapy in the Respiratory Complications of Quadriplegia

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Patients with traumatic quadriplegia have frequent respiratory complications. These complications may be exacerbated by the presence of common and previously well-tolerated allergic disease. Quadriplegic patients are limited in their ability to cope with upper and lower respiratory allergies by a reduced vital capacity and impairment of maneuvers needed to keep the upper and lower respiratory tracts clear. This report describes two patients with traumatic quadriplegia who were treated with allergen immunotherapy. After immunotherapy, both patients had negligible long-term postinjury respiratory complications and an improved quality of life. Allergen immunotherapy should be considered early in the management of allergic patients with traumatic quadriplegia.

KEY WORDS: Allergic; Asthma; Hypersensitivity immunotherapy; Quadriplegia; Respiratory insufficiency

It has been estimated that up to 20% of the population in the United States has allergy symptoms, including allergic rhinitis and asthma. The incidence of asthma itself varies among studies, with estimates up to 8.5% in the United States and other developed countries. It is therefore not surprising that patients with traumatic injuries, including quadriplegia, present with both severe neurologic damage and atrophy.

The treatment of allergic problems in patients with traumatic quadriplegia is complicated by their injuries and resulting disabilities. Antihistamines, which are a mainstay of the ambulatory management of allergic rhinitis, can be associated with anticholinergic effects and sedation. Drying of secretions may be a potential problem in these patients who are already prone to atelectasis. In addition, quadriplegic patients may have difficulty coordinating their breathing to effectively use metered dose inhalers. With increased emphasis in the allergy literature on the use of anti-inflammatory therapy for the treatment of asthma, this is a serious problem, since anti-inflammatory drugs such as cromolyn sodium and inhaled corticosteroids require the use of metered dose inhalers for convenient direct delivery. Cromolyn sodium can be nebulized, but it is not always effective; and the systemic use of corticosteroids has well-documented side effects, making them less than ideal for long-term use. This may be a particular problem in patients whose immobility already predisposes them to infection and osteoporosis.

Allergy diagnosis and treatment is advantageous to patients with atopic quadriplegia. Avoidance measures may improve allergic symptoms; however, when reduced exposure is impossible or brings inadequate relief, allergen immunotherapy is an appropriate alternative. This treatment approach was undertaken in the following two patients with apparent beneficial results.

CASE REPORTS

Case 1. A 19-year-old man was hospitalized with acute C5 quadriplegia in November 1988. His acute hospital course was marked by gram-negative sepsis, thought to be secondary to pneumonia and respiratory insufficiency. He eventually did well until February 1989, when he had upper respiratory complaints. He gave a long history of seasonal allergies, associated with productive cough. His symptoms occurred in the spring and fall, and at times were so severe that he would be sent home from school. He denied any history of wheezing or asthma but did describe "labored breathing" in the past.

On physical examination, his vital signs were normal. His ears were unremarkable, but there were moderate opaque secretions in his nasal airways, more prominent on the right than the left. Prick skin tests were applied to the patient's arms. Twenty-six allergens, selected for their prevalence in the Philadelphia metropolitan area, were tested. Allergens included tree, weed and grass pollens, Alternaria, hormodendrum, dust, and two dust mites (D farinae and D pteronyssinus). The testing was undertaken with commercial aqueous extracts. Single drops of these extracts, at concentrations of 1:20 weight per volume (w/v), were placed on the volar surfaces of his forearms. Using a barbed needle, the skin was pricked in the center of each allergen drop. The area of wheal, as well as the area of erythema, was measured and compared to simultaneously applied histamine and saline controls. Reactions were considered significant if they were appreciably larger than the saline control values.

Based on these results, an allergy vaccine was prepared at an initial concentration of 1:1,000,000 w/v. This was gradually increased over weeks to a maintenance concentration of 1:1,000 w/v, with each allergy injection consisting of 0.5cc. When this was well tolerated, and mild symptoms persisted, he was increased to 1:400 w/v and then to 1:200 w/v, as a final maintenance concentration.
Weight per volume is a commonly used measurement of concentration. It is the ratio of allergen weight to the fluid used to extract the allergen into an aqueous medium. The lower the ratio, the more concentrated the allergen. For example, 1:20 w/v is tenfold more concentrated than 1:200 w/v.

The patient was treated with beclomethasone aqueous, two sprays in each side twice daily. He initially received immunotherapy injections three times weekly while hospitalized in a rehabilitation center, which enabled him to reach his initial maintenance concentration (1:1,000 w/v) in three months. After reaching the maintenance phase allergy injections were given weekly. The patient remains on allergy vaccine, having been discharged from the rehabilitation facility in June 1989. Since April 1990, he has had no significant problems with allergy or respiratory insufficiency, and he is currently on no allergy medication.

Case 2. A 22-year-old man was hospitalized in June 1984 with C5 quadriplegia. He was initially transferred to the acute care unit in August 1984. He had a long history of seasonal allergies and asthma. His last “asthma attack” was at age 14. He attended college in Florida, where he believed his symptoms were somewhat improved. While hospitalized, during the acute phase, he had multiple respiratory problems and required repeated bronchoscopy. He was transferred in October to a rehabilitation unit, where he continued to have problems with atelectasis. Eventually, these problems resolved, and he was discharged from the rehabilitation unit in June 1985, approximately one year after his injury. His discharge medications included sustained-release theophylline, 500mg twice daily, and metaproterenol nebulization four times a day.

The patient was readmitted to the acute hospital in September 1985, with pneumonia and asthma. His vital capacity was 970cc, and his theophylline level was 28.6µg/mL on admission. He was treated with antibiotics and systemic corticosteroids in addition to his baseline asthma medications. Bronchospasm was required because of refractory atelectasis compounded by his quadriplegia. He was discharged in late September on theophylline.

In October, the patient underwent prick skin testing with a panel of allergens similar to that used in Case one. He was found to have strong reactions to several tree, weed, and grass allergens, and to dust and selected molds. An allergy vaccine was prepared, and specific allergy immunotherapy was commenced. He was started on a dose of 0.0cc of a 1:1,000,000 w/v vaccine. An initial maintenance concentration of 1:1,000 w/v was achieved without difficulty. The patient had progressive improvement in his symptoms. By August 1987, he was weaned off all asthma medications, at which time the vaccine concentration was 1:400 w/v. His only allergy-related medication at that point was pseudoephedrine in the morning, and a combination antihistamine/decongestant at bedtime. He had no problems with shortness of breath or asthma. He noted that his windows were generally left open during the local pollen seasons, without difficulty. His vaccine concentration was subsequently increased to 1:200 w/v, and his minimal residual complaints decreased. He has not required hospitalization for respiratory problems since 1985.

**DISCUSSION**

Patients with quadriplegia are prone to respiratory complications. The incidence of difficulty appears to decrease as the time interval from the acute injury lengthens. However, these patients remain significantly compromised. This compromise is secondary to neuromuscular weakness, which affects not only their ability to breathe, but also their ability to cough and clear secretions.

Allergen immunotherapy has been demonstrated to be both safe and effective for allergic rhinitis. Several studies have also demonstrated the efficacy of allergen immunotherapy in allergic asthma. Although some controversy persists as to the precise role of this form of treatment in conventional reactive airways disease, additional problems exist in the pharmacologic treatment of quadriplegic patients with asthma.

Much current evidence suggests that airway inflammation plays a major role in the asthmatic diathesis. Indeed, it has been suggested that the primary mode of treatment of asthma should be with anti-inflammatory agents, consistent with the fundamental pathophysiology of this illness, rather than with bronchodilators. Inhaled corticosteroids and cromolyn sodium are the safest means of treatment of mucosal inflammation of the lower airway. Although systemic corticosteroids have also been demonstrated to be effective, there are considerable side effects associated with them that would preclude their use, except for those patients where no alternative exists. Cromolyn sodium may be given via nebulizer, which facilitates its administration in patients with impaired ventilation. At this time in the United States, the only viable means of delivering inhaled corticosteroids is by a metered dose inhaler. This method requires considerable coordination on the part of the patient. Although aerosol deposition has not been studied in quadriplegic subjects, it is reasonable to propose that drug delivery may be suboptimal.

Treatment of allergic rhinitis consists of inhaled cromolyn sodium and corticosteroids, as well as antihistamines and decongestants. The latter medications may be associated with anticholinergic side effects, including drying of secretions, which may be particularly adverse in this population. Although not generally life-threatening, upper airway disease can be especially bothersome to patients who have difficulty producing adequate airflow to clear their upper airways, or independently using a tissue to physically remove secretions from their nose.

The principal risk of allergen immunotherapy is a systemic allergic reaction. This risk is quite small when appropriate precautions are taken, but life-threatening reactions can occur in a small percentage of patients. Allergen immunotherapy should ideally be restricted to facilities where the means of resuscitation are available, but under appropriate circumstances home administration may be considered.

Before his injury, the patient described in Case two had mild allergy symptoms involving his lower respiratory tract. He returned to the hospital shortly after his initial discharge, during the fall allergy season, with respiratory insufficiency, presumably secondary to infection, atelectasis, and the effects of his neurologic injury. We proposed that the pathophysiology of this illness included his “normal” fall allergy-associated increase in secretions, complicated by his neurologically impaired cough. At this time he has had a successful response to immunotherapy. He remains symptom free, even without the use of seasonal air-conditioning, except for temperature control. He requires no lower respiratory tract medications.
CONCLUSION

Although allergen immunotherapy has not been fully investigated in the treatment of quadriplegic patients with history of atopy, there are theoretical reasons for believing this to be a useful mode of treatment for this patient population. Allergen immunotherapy should be considered for quadriplegic patients as a means of reducing the incidence of postinjury pulmonary complications while increasing patient comfort. Because of the time required to reach effective doses of allergens when providing immunotherapy, requests for allergy evaluations of atopic quadriplegic patients should be made early in the rehabilitation process.

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References