

Original article

The burden of atopy and asthma in children

Background: There has been a world-wide increase in the prevalence of atopic diseases. These atopic diseases, including asthma, allergic rhinoconjunctivitis and atopic eczema/dermatitis, are common in childhood and create a challenge of management for physicians and parents.

Methods: MEDLINE was searched for articles related to atopy, allergy asthma, allergic rhinoconjunctivitis and atopic eczema/dermatitis.

Results and conclusions: The conditions of asthma, allergic rhinoconjunctivitis and atopic eczema/dermatitis cause very significant burdens regarding the discomfort to the affected individual, management problems for the parent and physician and the economic cost to the family and the nation.

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Burden is defined as 'something oppressive, worrisome or carrying a load' (1). In the newest nomenclature, atopy is described as 'a personal or familial tendency to produce immunoglobulin E antibodies in response to low doses of allergen, usually proteins, and, as a consequence, to develop typical symptoms such as asthma, rhinoconjunctivitis or atopic eczema/dermatitis' (2).

The burdens that these atopic diseases create in children are many and often range from the subtle to the profound. These conditions can and do have an impact on the child's physical health, social and emotional health and have a significant economic impact for the family's finances and the nation's health-care budget.

The purpose of this review is to consider the impact, or burden, that the major atopic diseases place on children and their families. The conditions of asthma, allergic rhinoconjunctivitis and atopic eczema/dermatitis will be briefly discussed from the aspects of their prevalence and the impact each has on physical and social health and also their economic impact.

Asthma

Background/prevalence

Asthma is a common and serious health problem. In the USA it is one of the nation's most common and costly diseases (3). It has a very substantial impact on health, quality of life and the economy (4). Asthma appears to be increasing in prevalence, with attendant increases in morbidity, economic costs and, in some countries, mortality. Some of the facts and figures about asthma are staggering. The overall prevalence rate for asthma in the USA is about 5–8% (5). Currently asthma affects about

20 million in the USA. There are approximately 2 million emergency visits and 500 000 hospitalizations from asthma yearly. There are about 5000 deaths per year from asthma in the USA.

Asthma is the most common chronic condition of childhood with approximately 4.8 million affected children in the USA. It is the major cause of school absenteeism, contributing to the estimated 10 million missed school days annually. Asthma is the number one cause of hospitalizations in childhood and deaths in children between the ages of 5 and 14 years almost doubled between 1980 and 1993 (6). The majority of asthma has its onset in childhood and it has been shown that 80–90% of patients are diagnosed by 6 years of age.

Physical/social impact

The standard measures of asthma's impact include mortality, urgent care visits, missed work and school days, but these reveal only part of the true burden of asthma in childhood in the USA (7). The condition of asthma may cause children to be uncomfortable as a result of coughing and/or wheezing, chest tightness, dyspnea and concomitant nasal congestion and/or rhinorrhea. Many have accompanying atopic eczema/dermatitis. Poorly controlled moderate to severe persistent asthma can be associated with some degree of growth retardation.

Asthma does have a significant impact on the quality of life. Often there are restriction of activities, interrupted sleep, disturbed routines, increased stress, and poor school performance. In a 1998 survey of individuals with asthma, 48% said they were limited in sports and recreation, 36% said they were limited in physical

exertion and 25% were limited in social activities. Approximately 30% had sleep disruption at least once a week. Seventy-eight per cent of parents said that asthma had a negative impact on their child's life (8). Examples given included those individuals with asthma who were not able to visit the homes of friends because of the presence of trigger factors such as cats, dogs, or parents who smoked cigarettes.

Economic impact

Collectively, for children and adults with asthma, the estimated annual cost is US\$14 billion in direct costs (those associated with medical treatment for the illness) and indirect costs (those associated with nonmedical output losses resulting from the consequences of the illness) (9,10). In a recent study by Cisternas et al. (11), the total per-person annual costs of asthma in the USA averaged \$4912.00, with direct and indirect costs accounting for \$3180 (65%) and \$1732 (35%), respectively. The largest components within direct costs were pharmaceuticals [\$1605 (50%)], hospital admissions [\$463 (15%)] and nonemergency department ambulatory visits [\$342 (11%)]. These are very large expenses for the patient, family and the health-care budget. Thus, the economic burden of asthma is huge!

Allergic rhinoconjunctivitis

Background/prevalence

Allergic rhinitis affects 20–40 million people in the USA annually including 10–30% of adults and up to 40% of children (12). Most have the onset of rhinitis in childhood with the mean age of onset between 8 and 11 years of age (13). Rhinitis can stem from many causes but allergy is the main factor. Other causes of rhinitis include such factors as nonallergic, irritant, infectious, hormonal, and occupational.

Physical/social impact

Rhinitis can cause loss of sleep and concomitant fatigue, headache, poor concentration, repeated nose blowing, itchy watery eyes, and general irritability.

There can be conjunctivitis, puffy eyelids and nasal congestion with rhinorrhea. Some children with rhinitis have associated partial nasal obstruction as a result of adenoidal hypertrophy. Adenoidal hypertrophy can in turn cause sleep apnea. Prolonged nasal obstruction and constant mouth breathing can be associated with an elevation of the upper lip, an overbite and a high arched palate. This situation can be a cause of dental malocclusion, which will often require dental correction. Not uncommonly in childhood, rhinitis is accompanied by ear disease such as recurrent otitis media or middle ear effusion with tympanic membrane retraction and immobility.

All of these factors impact negatively on the child's ability to carry out physical tasks as well as school/work-related activities.

Studies of classroom productivity and/or cognitive ability have been performed to assess the individual's ability to learn, recall, or process information. The Work Productivity and Activity Impairment Questionnaire results showed moderate to severe impairment in classroom productivity, work productivity and ability to perform daily activities in 93, 91 and 96%, respectively, of patients with allergic rhinitis. This impairment was significant enough that 25% of the individuals missed time from school or work (14).

Beyond the systemic effect of the disease itself, there can be further impairment with the use of over-the-counter first-generation (sedating) antihistamines. An interesting study was performed using a didactic computer simulation to evaluate the learning ability of children aged 10–12 years with allergic rhinitis compared with age-matched controls who were healthy. The groups that were studied included those with allergic rhinitis who were treated with a first-generation antihistamine (diphenhydramine hydrochloride) or a nonsedating antihistamine (loratadine) and placebo. The children were evaluated for factual and conceptual knowledge for the application of a learned strategy. It was clearly demonstrated that allergic rhinitis had a negative effect on learning. There was even further impairment with the use of the first-generation antihistamine (15). Other studies have shown that the condition of allergic rhinitis can also have a negative effect on memory, decision-making and self-image (16,17).

It can also take its toll on the social aspect of peer relationships. Numerous quality-of-life studies have documented the affect that rhinitis can have on the individual. One such study used an SF-36 (Quality of Life Questionnaire) in patients with moderate to severe allergic rhinitis and the authors found that the results were significantly different from healthy patients in eight of nine variables (18). Patients with allergic rhinitis had far worse quality of life compared to normal subjects. It has also been shown that with proper treatment of allergic rhinitis there can be significant improvement in the quality of life (19). Settipane (20) has described the complications of untreated or under treated allergic rhinitis which can lead to further burdens of sleep impairment, acute and chronic sinusitis, hearing impairment, and aggravation of asthma.

Economic impact

The costs of treating rhinitis and the indirect costs related to loss of work-place productivity resulting from the disease are substantial. The estimated cost of allergic rhinitis based on direct and indirect costs was \$2.7 billion in 1995, exclusive of the costs for associated problems such as sinusitis and asthma (12). In a study by Law et al. (21) of US patients it was determined that the total direct

cost of allergic rhinitis was estimated to be about \$3.4 billion, with the majority attributable to prescription medications (47%) and outpatient visits (52%). It was found that the direct costs of allergic rhinitis have increased since the introduction of second-generation antihistamines and intranasal corticosteroids. This all adds up to a very significant financial burden.

Atopic eczema/dermatitis

Background/prevalence

Atopic eczema/dermatitis is estimated to affect 15–20% of the childhood population and there is considerable evidence that the prevalence is increasing (22,23). This condition is frequently under treated and dismissed as a nuisance and yet it can have a large social/emotional and financial effect on the child and family. The condition of atopic eczema/dermatitis also commonly predates the development of allergic rhinitis and asthma.

Physical/social impact

Children with atopic eczema/dermatitis are often very uncomfortable because of the intense pruritus, which causes excessive scratching. There may be scaling and lichenification of various locations on the skin of the extremities including the popliteal fossa and the antecubital area. The skin is usually very dry. Concomitant rhinitis and asthma are common. Children with severe atopic dermatitis may have growth retardation.

The condition of atopic eczema/dermatitis can take its toll on infants and children and their parents. The appearance of the scaly weepy skin of an infant with atopic eczema/dermatitis may inhibit the normal touching and bonding between the child and the mother and father. Many infants with this condition are very irritable and uncomfortable and these factors can affect the parent's care-taking confidence. There are difficulties with getting the child comfortable and often the parents cannot get their child to sleep. The parents often express feelings of inadequacy. The preschooler who shows a great amount of scratching becomes very difficult to manage and parents at times begin to question if the child is using this as a weapon. Many notice that their child's reaction to stress is that of increased scratching. School-aged children with atopic eczema/dermatitis are very concerned about their appearance and this can have a tremendous affect on peer relationships. Some will curtail activities such as swimming or will avoid certain types of clothing such as short-sleeved shirts in an attempt to avoid embarrassment. School absenteeism can result, which can in turn interfere with their learning. In some quality-of-life studies atopic eczema/dermatitis was found to have a bigger impact on the family than diabetes (24).

Lapidus et al. (25) obtained very striking results in a questionnaire study of parents of children with atopic eczema/dermatitis. These included the following: 71% felt guilt, exhaustion, frustration, resentment and helplessness over their child's condition; 66% felt that their family life-style was not normal because of avoiding pets and certain foods; 63% reported sleep disturbance of both the child and the parents; 60% said their child was teased at school and had poor school attendance; 54% said their child was irritable and angry, and approximately 11% said the financial cost had a significant effect on their life-style. Kemp found that the family stress associated with the care of children with moderate to severe atopic dermatitis was significantly greater than that of type 1 diabetes mellitus (26). The major factors contributing to the stress were sleep deprivation, loss of workdays, time taken to care for the atopic dermatitis and financial costs (26).

Economic impact

There are significant economic costs involved with caring for children with atopic eczema/dermatitis. Su et al. (24) found that children with moderate atopic eczema/dermatitis had an average of 13 physician visits per year at a cost of about \$1700.00 annually for the family. Those with the severe form averaged 23 physician visits with a cost exceeding \$2500.00. The data indicated that the financial cost of managing this condition was more expensive than caring for a child with asthma. Lapidus et al. (25), working in the 1990s, estimated the US national cost of treating atopic eczema/dermatitis at \$364 million annually. Lawson et al. (27), in a British study which incorporated not only the physician visits and treatment but also work loss by parents, reported losses as high as \$700 million per year.

Modifying or preventing atopic disease

We need to attempt to prevent or modify the occurrence of these atopic diseases. Early diagnosis and prompt management are the keys. Asthma is diagnosable and very treatable. If triggering factors can be identified, excellent options for management exist. Allergic rhinoconjunctivitis is also very diagnosable and superb forms of treatment are readily available. Similarly with atopic eczema/dermatitis, it is readily diagnosable and currently excellent forms of treatment exist. If food is a causative factor for the atopic eczema/dermatitis it can be tested for, identified, and avoidance measures can be instituted.

Parents of infants either with or predisposed to atopy are now confronted with difficult decisions regarding diet and environmental control measures. There is evidence that exclusive breast-feeding for the first 6 months without solids being introduced does reduce the occurrence of some of the atopic conditions (28–30). It would appear that breast-feeding should be encouraged for

mothers who have infants at risk. The use of probiotics has been shown to be helpful in preventing or modifying the occurrence of atopic eczema/dermatitis and rhinitis (31). Some infants born of mothers who had smoked cigarettes during pregnancy were found to have diminished lung function and were at risk of developing asthma (32). Of course mothers of infants at risk for atopy should be strongly discouraged from smoking during pregnancy.

Environmental control decisions for children at risk for the development of atopic disease have become more controversial. Recent studies of the hygiene hypothesis have challenged our paradigm of rigid environmental control (33). The typical advice in the past has been for families at risk to avoid exposure to pets and to reduce exposure, when possible, to infectious diseases such as the common cold. Recent studies indicate that children who grew up in homes where there were pet cats and/or dogs had less atopic disease as they grew older (34). Ball et al. found that children with more frequent viral upper

respiratory problems have less atopy as they grow older (35). Many parents face the decision of whether the mother stays home or returns to work and places the child in day-care. The findings of these various studies have created confusion not only for the physician, who needs to give recommendations to the family for environmental control and day-care, but also for the parent. Long-term studies are needed to clarify some of these issues.

Summary

The burdens created by the common conditions of asthma, allergic rhinoconjunctivitis and atopic eczema/dermatitis are huge. These conditions can affect the individuals' physical and social health and cause an immense financial burden to the family and to the nation's health-care budget.

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