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Pediatric Asthma: An Integrative Approach to Care

John David Mark, MD

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Asthma in children and young adults is a complex disease with many different phenotypic expressions. Diagnosis is often made based on history and lung function including measuring airway reversibility. However, in children younger than 6 years of age, the diagnosis is more difficult because many children wheeze in the first 4-6 years of life, especially with viral infections. For those children, asthma treatment is often started empirically. Those who go on to develop chronic asthma most likely have a genetic predisposition and exposure to various environmental factors resulting in chronic inflammation of the lower respiratory tract. There are established national guidelines for diagnosing and treating asthma in children and adults. For persistent asthma, it is recommended that medications be taken on a regular basis after identifying and avoiding environmental triggers. Because many factors play a role in developing asthma in children, many

nonmedical approaches to asthma and asthma-like conditions have been promoted even when the diagnosis is at times uncertain. The nonmedical approaches and therapies are often referred to as complementary and alternative medicine (CAM). This review will discuss the conventional therapies recommended for children with asthma in addition to CAM therapies, some of which have supporting scientific evidence. Integrating conventional and CAM therapies can prove to be an effective way to treat pediatric asthma, a common and chronic childhood lung disorder. A case is provided to illustrate how such an integrative approach was used in the successful treatment of a child with moderate persistent asthma. (*Nutr Clin Pract.* 2009;24:578-588)

Keywords: asthma; complementary medicine; holistic medicine

Asthma in children and adults is a chronic inflammatory disorder of the airways that affects more than 22 million people. Asthma is one of the most common chronic diseases in childhood with an estimated 6.7 million children diagnosed; additionally, approximately 7% of Americans have asthma.¹ Characterized by airway obstruction, asthma results in shortness of breath, cough, chest tightness, and possibly wheezing. Obstructions occur due to bronchoconstriction of the airway smooth muscle, airway inflammation, and excessive mucus production. The airways are infiltrated with various inflammatory cells including eosinophils and mononuclear cells. Other findings include damage at the airway epithelial cell level with cellular leakage in the microvascular space. The increase in mucus production is due to an increased number of goblet cells and may cause plugging of the smaller airways. The smooth muscle is hypertrophied and is characterized by new formation of vessels and an increase of interstitial collagen, particularly beneath the basement membrane of the epithelium.

These findings are important in that this chronic inflammation may ultimately result in irreversible changes in the airway structure.^{2,3} These changes lead to advocating the use of anti-inflammatory medications such as inhaled corticosteroids (ICS) early in the treatment of asthma. However, which children will go on to develop the irreversible changes is not known even with the use of ICS.

The number of asthma exacerbations, asthma-related hospitalizations, and deaths have decreased over the past decade, despite the high prevalence of the disease. This may be in part due to improved recognition and the use of anti-inflammatory medications such as inhaled corticosteroids, but the burden of asthma is significant and hospitalization rates in children 0-4 years have actually increased. There are also socioeconomic, ethnic, and racial disparities in treating asthma, which may be due to genetic variation in response to medications and also problems in accessing asthma care.⁴ The overall improved control and treatment of asthma despite its high prevalence is thought to be due in part to the increasing adoption of standard guidelines for the treatment of asthma using medications, environmental control, and education. Conventional medications used in the treatment of asthma are used in accordance to their role in overall management: quick relief and long-term control.⁵ The quick relief medications are bronchodilators usually represented by short-acting inhaled β_2 -agonists (SABA) and when administered by inhalation result in rapid reversal of airflow

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obstruction and relief of asthma symptoms. The quick relief medications act within 5 minutes and their effects may last as long as 4-6 hours. These have become the mainstay of asthma treatment for acute symptoms and for pre-exercise prophylaxis.

Long-term control medications have allowed children and adults with asthma to have fewer exacerbations and, if used in addition to avoidance of asthma triggers, have resulted in improved asthma control. The long-term controller medications used are primarily ICS. When used regularly, the airway inflammation decreases with fewer eosinophils, mononuclear cells, and reduced mucus-producing cells in the submucosa or the airways. However, these benefits generally do not persist when the ICS are discontinued or if there are additional factors that trigger airway inflammation (such as environmental tobacco smoke or certain viral illnesses). In fact, once the ICS are discontinued, the inflammation returns to pre-ICS therapy level 6 in several weeks, thereby producing only short-term benefits.⁶ For severe asthma, there are medications with greater potency which are a combination of ICS together with a long-acting β -agonist. These medications decrease inflammation and may provide bronchodilation for up to 12 hours. There are other controller medications that are usually not as effective as ICS. These nonsteroidal medications include leukotriene modifiers (which block the bronchoconstricting action of leukotriene C₄, D₄, and E₄), the cromoglycates (cromolyn and nedocromil which stabilize mast cells from releasing inflammatory mediators), and theophylline preparations. The National Asthma Education and Prevention Program (NAEPP) of the National Heart Lung Blood Institute (NHLBI) has developed guidelines to assist healthcare providers in the diagnosis of asthma, assessing control of asthma, and providing a step-wise management plan in addition to environmental control measures to avoid or eliminate factors that precipitate asthma symptoms and exacerbations. Pharmacologic therapy (see Table 1) for long-term management along with patient education regarding the use of their medications and environmental control are the basis for conventional therapy for asthma.

The use of controller medications, such as ICS, has made a significant impact in the care of children with chronic asthma. The clinical effects of these medications include reduction in severity of symptoms, improvement in quality of life and lung function (such as peak flow and spirometry), and diminished airway hyperresponsiveness. ICS have also been shown to decrease asthma exacerbations; reduce the need for systemic corticosteroid courses, emergency department care and urgent care visits, and hospitalizations; and decrease deaths due to asthma. They may also attenuate the loss of lung function in adults. Despite these significant improvements in asthma care, several potential side effects and complications are associated with the use of chronic steroids, even when administered

Table 1. Conventional Pharmacologic Therapies Used in Asthma

Inhaled corticosteroids
Short-acting β_2 -agonists
Long-acting β_2 -agonists
Long-acting β_2 -agonists combined with inhaled corticosteroid
Leukotriene modifiers
Cromoglycates

only by inhalation: decreased height velocity, oral candidiasis, dysphonia, and cough. Higher doses of ICS have been associated with the development of cataracts and adrenal suppression. Patients and families will often withhold ICS in favor of non-pharmacological treatments. This reluctance, in addition to the potential overuse of SABA, may lead to the under-treatment of children with asthma. The causes and variability of asthma often lead patients and families to seek therapies other than conventional medications. Symptoms associated with asthma range from mild to severe and often begin in infancy. The severity of asthma is believed to be in part the result of genetic predisposition and environmental exposures. The ability to modify a child's genetic heritage is limited, but certain environmental factors more likely are amenable to the variety of interventions. Conventional management of asthma in addition to medications includes identifying and eliminating triggers that may aggravate asthma. At times, allergy testing for airborne and food allergens (pollens, house dust mites, pet dander, peanuts, etc.) are used. However, allergy testing is expensive and some families do not comply with such things as pillow and mattress covers, home filtering systems, and other measures to decrease allergen or irritant exposures. Studies have also shown that often parental medication beliefs play a significant role in the child's asthma medication adherence.⁷ For these reasons, CAM therapies, from diet to herbal medications to breathing exercises and yoga, have also become popular in treating asthma.

By using both conventional and complementary and alternative medicine (CAM) therapies, an integrative approach may lead to better adherence and control of asthma in children, but this has yet to be studied.

Complementary and Alternative Medicine Modalities

CAM is popular in the treatment of asthma and encompasses many therapies, including mind-body techniques, nutrition manipulation, dietary and herbal supplements, traditional Chinese medicine (including acupuncture), exercise, manual therapies, and homeopathy. CAM has been defined by the National Institutes of Health's National Center for Complementary and Alternative

Medicine as diverse medical and healthcare systems, practices, and products that often are not integrated with conventional medicine or therapies. CAM also is described as a broad domain of healing resources that encompasses all health systems, modalities, and practices and their accompanying theories and beliefs other than those intrinsic to the politically dominant health system or culture in a given historical period.⁸ Modalities considered as CAM in one country may be considered part of the standard treatment in another country or region. While studies have been undertaken to determine the extent of CAM use in the pediatric population with asthma, the lack of a uniform definition of CAM has resulted in reports of varying prevalence rates of CAM usage up to 89% in children.⁹

The most commonly used CAM therapies in children are herbal products as well as vitamins and minerals, breathing techniques, massage, homeopathy, and prayer. Given the common use of these modalities in children who have asthma, the variable disclosure to healthcare providers, and the potential life-threatening nature of the disease, it is important to know which factors might predict CAM use.

Reportedly, CAM is commonly used in children who have mild or moderate persistent asthma, those receiving high-dose ICS, and patients who have had poor symptom control or frequent physician visits, including emergency room visits.¹⁰⁻¹² One study found CAM use among children 5-12 years old who had asthma (as reported by their parents) at 65% with usage highest among families who were African-American, poor, and not well educated. CAM use was not limited to those with severe asthma. The study concluded that because of the high prevalence of CAM use for pediatric asthma, healthcare providers should educate themselves about these CAM therapies to better discuss the implications of using these therapies and potentially improve adherence to the prescribed conventional medications regimen.¹³

While there have been some high-quality studies investigating the use of CAM therapies that have demonstrated evidence for safety and efficacy, some CAM therapies do not lend themselves to evidence-based medical research for a variety of reasons, ranging from patient preference to highly individualized approaches. For these reasons, if a patient or family wishes to use various CAM therapies, a thorough discussion reviewing the risks and benefits of using such therapies should be done as when prescribing conventional therapies such as ICS. This integrative approach of using both CAM and conventional therapies may result in improved overall adherence, because, as shown in 1 study of adult patients, 79% of the subjects believed that using a combination of conventional and CAM therapies was better than using either one alone.¹⁴ Because CAM modalities are often perceived as safe and effective by patients, it is important for

Table 2. Common CAM Therapies Used in Asthma

Mind-body
Nutrition/diet
Dietary supplements
Traditional Chinese medicine
Exercise
Manipulative therapies
Homeopathy

healthcare providers to know what has been studied and what potential interactions may arise between CAM therapies and conventional medical care. Given the prevalent usage of CAM therapies, healthcare providers are becoming interested in learning about CAM therapies and how they may be integrated with conventional treatments but such education is often challenging. Clinicians can be overwhelmed by information and even hesitant to discuss such options with their patients because of liability risk and the perceived time that would be required. A recent approach has been described by Engler et al suggesting certain key elements of physician-patient interactions when discussing CAM therapies that may reduce perceived barriers. These elements include: exploring the reasons for the patients' interest in CAM, documenting the clinical condition for which they seek CAM therapies, assessing the control and severity of the current illness, documenting the patients' preferences and reasons, assessing the adequacy of the medical evaluations, evaluations, plans for consistent follow-up visits, providing access for close communication with option for further consultative visits, acknowledging evolving expectations and goals, reviewing safety and efficacy issues related to proposed CAM therapy or therapies, and addressing need for further consultations and how these can be optimized.¹⁵

Table 2 exhibits the most commonly used CAM therapies in asthma. Some have only a traditional history to support their use, but there are others where scientific research has been done to support their use either with conventional asthma treatment or as a safe alternative. The following discussion will provide an overview of these modalities.

Mind-Body Therapies

Mind-body therapies are cognitive behavioral therapies that may include modalities such as relaxation therapy, breathing exercises, biofeedback, self-hypnosis, and guided imagery. These have been used in the treatment of asthma with research dating back over 40 years. The theory behind using such therapies is based on inflammation being triggered by the autonomic nervous system through emotions. Emotions, such as stress, reportedly are associated with an

increase in morbidity and cytokine levels due to airway inflammation in children from lower socioeconomic groups.¹⁶ Anxiety has also been shown to influence the immune response and may promote an elevation in sympathetic activity, increased IgE production, and shift T helper 1 (Th1) to Th2 allergic-type response, which could promote airway inflammation even without overt clinical symptoms.¹⁷ Older studies using relaxation, self-hypnosis, and storytelling resulted in a decrease in fast-relief medication use and symptom reporting.¹⁸ One study demonstrated that by instructing 72 children with chronic lung problems (average age, 11.6 years) in self-hypnosis, 82% reported improvement or resolution in symptoms such as anxiety, asthma, chest pain, dyspnea, habit cough, sighing, and vocal cord dysfunction.¹⁹

Breathing exercises have also been considered a type of mind-body therapy. Abnormal breathing patterns have been seen in asthma patients and include breathlessness, chest tightness, chest pain, and light-headedness usually associated with hyperventilation.²⁰ The American Lung Association and the Center for Disease and Prevention through the Open Airways for Schools (OAS) has taught belly breathing (diaphragmatic breathing) to help patients with controlling asthma symptoms, especially when anxiety is present. Other types of breathing exercises include the Buteyko technique, which teaches decreasing the respiratory rate to allow increased alveolar carbon dioxide resulting in bronchodilation. Randomized controlled trials have shown some positive results using such breathing methods and asthma.²¹ A Cochrane review concluded that breathing exercises for asthma such as Buteyko, yoga, and diaphragmatic breathing resulted in reduced of SABA and a trend toward improvement in quality of life, although the amount of anti-inflammatory medications such as ICS was not less, airway reactivity did not decrease, and improvements in lung function were not found.²²

Nutrition

The role of nutrition in the development of asthma is thought to be important. With the increasing prevalence of asthma, there has been an accompanying change in the types of foods eaten in industrialized countries with a decrease in vegetable and fruit consumption, and an increase in consumption of fruit juices, high fructose corn syrups, and vegetable oils.²³ Many foods may now travel some distance (even distant countries), and with such, the nutrient content may have decreased due to different farming techniques, increased storage time, and transportation. As an example, vitamin C in fruit may be reduced dramatically if the fruit is stored longer than 2 weeks. Fetal undernutrition has been shown in experimental animal models to affect the developing immune system and poor fetal lung growth may lead to increased prevalence of atopy.²⁵ Because diet is the major source of antioxidants,

when the mother's prenatal intake is poor and there is a continuation of inadequate intake during infancy, airway growth may be affected, leading to airway damage and reduced airway compliance.²⁶ Nutrient-poor diets, including those with insufficient antioxidants, are often accompanied by inadequate ω -3 fatty acids from oily fish (tuna, herring, mackerel, and salmon) and fish oils (cod liver oil). Insufficient consumption of ω -3 fatty acids is generally observed with a greater ingestion of ω -6 fatty acids which are present in margarine and vegetable oils. It has been hypothesized that the consequence of increasing ω -6 and decreasing ω -3 fatty acid intake may cause an increase in arachidonic acid and prostaglandin E-2 production with consequent increase in atopic Th2 sensitization, atopic disease, and asthma.²⁷

There have been epidemiological studies showing the beneficial association of a diet high in fruits, vegetables, and other antioxidant-rich foods. An example is a study investigating the benefits of the Mediterranean diet in 690 children. The traditional Mediterranean diet includes unprocessed foods such as fruits and vegetables, bread and cereals, legumes and nuts, with olive oil being the primary oil consumed. This diet (which provides many sources of dietary antioxidants) was found to be protective against wheezing and atopy.²⁸ In a larger study, Burns examined the association of dietary factors (fruit, vegetables, vitamin C, vitamin E, β -carotene, retinol, and ω -3 fatty acids) in 2,112 high school students in the United States and Canada.²⁹ It was hypothesized that intake of fruits, antioxidants, and other micronutrients may prevent or limit the inflammatory response. Because adolescents often have poor dietary habits, this group of children may have reduced lung function as measured by pulmonary function testing. Using questionnaires, it was found that the intake of dietary fruit and vegetables, vitamin E, vitamin A, β -carotene, and ω -3 fatty acids was low in over one-third of the students. The decreased fruit intake was associated with reduced lung function using the forced expiratory volume in 1 second (FEV₁) as well as increased report of chronic lung symptoms such as cough in addition to asthma. Low vitamin E intake was also associated with an increased frequency of asthma; lower intakes of dietary ω -3 fatty acids were associated with an increased report in chronic cough, wheeze, and asthma compared with higher intakes. The authors concluded that reduced pulmonary function, chronic cough, and wheezing were found more often in adolescents with low vs high dietary micronutrient intake. Promoting fruit and fish consumption in addition to vitamin supplementation may be necessary to ensure an adequate intake of antioxidants and ω -3 fatty acids in this group of growing adolescents.

It may be that dietary interventions such as increased antioxidant intake might be particularly important during pregnancy and early childhood. However, it is not clear that using such interventions will help children and young adults who already have evidence of lung problems such

as asthma. In the Childhood Asthma Prevention Study (CAPS), 616 children were randomized to a diet intervention with fish oil supplements together with monitoring of dietary ω -3 fatty acids and ω -6 fatty acid intake. Of the 189 children who completed all parts of the study, there was no association between plasma levels of ω -3 or ω -6 fatty acids at various time intervals (10 months, 3 years, and 5 years), and the prevalence of asthma or wheezing illness, eczema, or atopy at 5 years.³⁰ This illustrates the need for further research in dietary intervention both clinically and as a public health measure to evaluate its role in reducing and treating asthma. Nutrition and dietary interventions may be important in combination with environmental conditions (such as exposure to environmental tobacco smoke and air pollution) and underlying genetic predisposition in improving overall lung health.

Dietary and Herbal Supplements

Dietary supplements are products that are intended to supplement the diet and may include many ingredients such as vitamins, herbs, or minerals. They are for ingestion in pill, capsule, tablet, powder, or liquid form. Herbal supplements are a type of dietary supplement that often contain parts of plants including flowers, leaves, stems, bark, berries, seeds, and roots. Herbal supplements may come in a variety of forms such as pills, freeze-dried capsules, or powders. They may also be given as tinctures, syrups, or brewed in teas and decoction. Herbal remedies are commonly used for the treatment of asthma and in survey studies are often the most common CAM therapy used. In a review of 17 studies including 7 pediatric groups, the use of herbal supplements (including herbal medicines, minerals, vitamins, honey, teas, quail eggs, naturopathy, and Ayurvedic therapies) ranged from 12% to 53% of patients surveyed.³¹

The use of herbal remedies and dietary supplements in general has caused concern due to the possibility of drug-nutrient/herbal interactions with conventional medications and even other supplements. Additionally, the active ingredient(s) in herbal supplements is not always known as these types of supplements may contain many unknown compounds and active ingredients. This, in turn, makes it difficult to understand the precise mechanism by which herbal supplements affect the body in such conditions as asthma. The safety of herbal supplements has been questioned due to the reporting of many supplements being contaminated with metals, unlabeled prescription drugs, microorganisms, and other substances.³² In the United States, herbal and other dietary supplements are regulated by the U.S. Food and Drug Administration (FDA) as foods. This means that they do not have to meet the same standards as drugs and over-the-counter medications for proof of safety and effectiveness. In the summer of 2007, the FDA announced new regulations

requiring rules for good manufacturing practices that previously have not been well enforced. These rules were introduced to ensure that dietary supplements are produced in a quality manner, do not contain contaminants or impurities, and are accurately labeled. However, there has been little proactive monitoring done by the FDA. In general, manufacturers are not required to register their products or have FDA approval; however, the FDA is responsible for taking action against any unsafe dietary supplement product after it reaches the market, along with making sure that the product label information is truthful and not misleading. The FDA's post-marketing responsibilities include monitoring for safety including adverse event reports and labeling claims.

Studies examining the use of herbal supplements in the treatment of asthma have been completed, including several in children. One study investigated the use of butterbur (*Petasites hybridus*) in children and adults with asthma.³³ Butterbur is a perennial shrub that has traditionally been used for treatment of urinary problems, back pain, wound healing, and asthma. This study was a prospective, nonrandomized trial with 64 adults and 16 children who had mild to moderate asthma. The subjects took butterbur for 8 weeks in addition to their regular asthma medications; the number and duration of asthma exacerbations were monitored. The incidence of exacerbations decreased in 48% of the subjects and the duration of the exacerbation decreased for 75% of the subjects. A reduction in the dose of inhaled corticosteroids (42.9%) and in the use of SABAs (48.3%), as well as an improvement in lung function measuring FEV₁, and peak flow (70.6 and 83.9%, respectively) was also noted. The butterbur was generally well tolerated, but 11 adverse events were reported in 7 subjects; however, all events were considered mild complaints.³³ This study was limited by the lack of blinding and small sample size.

In another study with an improved design, Lau et al³⁴ investigated the use of herbal supplements for the treatment of asthma in children. In this randomized, placebo-controlled, double-blind study involving 60 children 6-18 years old with mild to moderate asthma, pycnogenol (a mixture of water-soluble bioflavonoids extracted from French maritime pine) was evaluated for efficacy. Pycnogenol is thought to decrease airway inflammation. In this study, peak flows, symptoms, medication use, changes in oral medications along with urine samples for inflammatory markers (leukotrienes C4/D4/E4) were measured. In the group who took pycnogenol for 3 months, significant improvement in pulmonary function and asthma scores along with a reduction in urinary inflammatory markers was found. The pycnogenol group also was able to reduce or discontinue their use of SABAs (rescue medication) more often than the placebo group. This included 18 of 30 subjects in the pycnogenol group who did not use their rescue medication at all during the

third month. It was thought that this herbal supplement may have anti-inflammatory properties and be helpful in treating children with asthma. In an adult study with 40 subjects with asthma using *Boswellia serrata* gum (thought to inhibit leukotriene synthesis), a double-blind, placebo-controlled 6-week study showed that in the group taking the gum resin, a 70% decrease in physical symptoms (dyspnea and number of attacks) and an improvement in lung function (peak flow measurements) occurred.³⁵ They also demonstrated a decrease in eosinophilia in peripheral blood and a reduced erythrocyte sedimentation rate.

There have been other studies investigating herbal remedies and other dietary supplements such as minerals and vitamins in the treatment of asthma. The majority of these studies have been in adult populations. Some examples of supplements studied include *Tylophora indica*,³⁶ ginger,³⁷ and *eucalyptol*.³⁸ Considerable interest in studying the role of antioxidants including selenium, vitamin C, and α -carotene has also grown as antioxidants may help prevent or modulate the production of reactive oxygen and free radicals which may lead to bronchial inflammation and airway hyperreactivity.³⁹ Other vitamins with immune properties (vitamins A and D) have also been studied to evaluate their role in either preventing or increasing respiratory symptoms such as asthma. In a Cochrane review of vitamin C supplementation for asthma,⁴⁰ 71 abstracts and reports were analyzed; 8 studies met selection criteria for review. Of the 8 studies, 1 involved children and 1 involved both children and adults. All studies were placebo-controlled and randomized. The Cochrane review concluded that there was insufficient evidence to recommend a specific role for vitamin C in the treatment of asthma. Selenium is an antioxidant that may suppress airway inflammation in asthma by increasing glutathione peroxidase in the airway epithelial lining fluid.⁴¹ In a randomized, double-blind, placebo-controlled trial of 197 adults with asthma, there was no significant improvement in asthma-related quality of life questionnaire scores or measures of lung function, asthma symptom scores, peak flow measurements, or medication usage.⁴² Therefore, the routine use of vitamin C and selenium to improve asthma or prevent asthma exacerbations has not yet been shown.

Magnesium is a supplement that is known to be a potent bronchodilator. It is often used intravenously for children and adults with severe asthma exacerbations requiring emergency treatment. Magnesium is found in the normal diet in a variety of foods such as whole seeds, grains, nuts, and vegetables. Dietary surveillance studies conducted by the United States Department of Agriculture (USDA) show that children's mean intakes of some minerals including magnesium is below the Recommended Daily Allowance (RDA). It has also been noted through epidemiological data that low magnesium intake is associated with airway hyperreactivity and self-reported wheezing.⁴³ Magnesium is frequently promoted as a routine supplement for asthma by

alternative healthcare providers and is an ingredient of many herbal supplements marketed for improving lung health. Recently, a study was conducted investigating the effects of oral magnesium supplementation on clinical symptoms, bronchial reactivity, lung function, and allergen-induced skin responses in children with moderate persistent asthma.⁴⁴ This randomized, placebo-controlled study included 37 subjects aged 7-19 years. After 2 months of therapy, the magnesium group had reduced airway reactivity and skin responses to known allergens, as well as fewer asthma exacerbations and the need to use rescue medication compared with the control group. That both groups were taking a controller medication, fluticasone, an ICS, is notable. Baseline pulmonary lung function was similar in both groups. The role of magnesium in general treatment of asthma in children and adults should be studied further given the potential benefits for children with asthma observed in this study.

The Internet lists hundreds of different herbal and dietary supplements for asthma therapy, including ginkgo, aloe, chamomile, garlic, ginger, horehound, licorice, marshmallow, mullein, onion, lobelia, yerba santa, and many more. These herbs have been used by traditional herbalists for a variety of respiratory problems in children and adults. Few, if any, of these treatments have any scientific evidence supporting their use in children for asthma or chronic pulmonary disorders. An in-depth discussion of the potential use of these herbs is beyond the scope of this article; thus, the reader is referred to an excellent review article recently published by Mainardi et al⁴⁵ regarding herbs, phytochemicals, and vitamins, and their potential interaction with the immune system especially regarding asthma, allergic rhinitis, and atopic dermatitis.

Traditional Chinese Medicine

Traditional Chinese medicine (TCM) has been practiced for thousands of years and is based on the understanding of the connection between body, mind, and spirit in health and illness. An unseen vital energy or qi (chi) affects the patient's health; how this energy flows through the appropriate channels is monitored and evaluated by the TCM practitioner who can manipulate the flow of energy and balance using acupuncture, Chinese herbs, diet, and physical therapy. A growing field of literature in herbal remedies for asthma stems from those used in TCM. Asthma has been recognized in TCM for centuries and there are traditional formulas prescribed, usually combining several herbs together. A classic Chinese herbal remedy used for breathing disorders such as asthma was ephedra (Ma huang or *Ephedra sinica*). The pharmaceutical ephedrine derived from Ma huang was used in conventional asthma therapy until more specific β -agonist medications became available. Ma huang may be present in many combinations of other botanicals for respiratory problems, including licorice which is thought to enhance airway

clearance through its mucilaginous properties. Recently, Ma huang was marketed in combination with other stimulant herbal supplements such as caffeine and caffeine-related products (often promoted for weight loss and energy). However, significant cardiovascular side effects associated with its use, including death, have been reported.⁴⁶ For this reason, ephedra is no longer recommended in the treatment of asthma due to warnings from the FDA.

In addition to Ma huang, TCM uses other herbal combinations that are individualized based on a patient's specific symptoms. These herbs are then usually decocted (concentrated by boiling) in the preparation for patient use. The balance and interaction of the herbs (usually 5-10 as a mix) are believed to be as important as the effect of the individual herb. It is believed that the complex interaction produces synergistic effects and reduces possible side effects of some of the individual herbs. In the last several years, there have been several double-blind, placebo-controlled clinical studies investigating both the safety and efficacy of Chinese herbal supplements in both the treatment and the mechanism of asthma. Although few studies have reported using various herbal supplements in children with asthma, a recent review presented an update on some of the more promising Chinese herbal remedies for asthma.⁴⁷

Acupuncture is another modality that is commonly used as a TCM therapy for asthma. Although there has been research into the use of acupuncture for asthma, most studies have not supported the use of acupuncture in children or adults for either chronic or acute therapy. A Cochrane review of 11 studies for acupuncture and asthma concluded that there is not enough evidence to make recommendations about the value of acupuncture in asthma treatment.⁴⁸ The review's conclusion recommends further research considering the complexities and different types of acupuncture. That being said, some researchers suggest that the lack of positive findings in acupuncture and asthma studies is in part due to the model of research being used.⁴⁹ Extracting or isolating the effect of a specific therapy may interfere with the positive outcomes that are not part of the study design. TCM is a holistic approach to a chronic problem and acupuncture is but 1 part of the therapeutic relationship making acupuncture difficult to study by itself.

Exercise

Exercise is both a conventional and CAM therapy. It could be considered an "energy" medicine or even a mind-body therapy because exercise has been used for depression and anxiety. Exercise in children and adults with asthma should be prescribed with caution because exercise can induce symptoms in patients. However, there have been several relatively small studies showing that subjects with asthma can achieve better control of the symptoms with regular exercise.⁵⁰ As to what type of exercise

is recommended, there is no study illustrating the superiority of one type of exercise over another. Swimming has been promoted as the ideal exercise for children and adults with asthma because the environment is moist, and cold dry air may exacerbate asthma symptoms. Studies have not supported this, and it is now recommended that any exercise that the patient will do on a regular basis that does not cause an increase in symptoms should be encouraged. In particular, older patients may improve their asthma symptoms if they follow a routine exercise regimen. This probably is in part due to improving their self-image which may lead to better adherence to their overall asthma treatment plan. Yoga could be considered a form of exercise that includes a cardiovascular component, regulated breathing (pranayama), relaxation, and meditation. Yoga has been shown to help decrease medication use and decrease anxiety in adults with asthma.⁵¹

Manipulative Therapies

Manipulative therapies include a variety of techniques that are commonly used as part of CAM in the treatment of asthma and other pulmonary conditions. These include chiropractic manipulation, massage therapy, osteopathic manipulation, and vibrational therapy. Chiropractic physicians have used spinal manipulation as a standard of care for asthma for many years. A randomized controlled trial of chiropractic manipulation in 91 children with mild to moderate asthma did not show any benefit from the manipulation. There were no improvements in peak flow measurements of quality of life scores or reductions. In a smaller study, 36 subjects, ages 6-17 with mild to moderate asthma, were given chiropractic spinal manipulative therapy (SMT) plus their usual asthma medical management. Outcome measurements included pulmonary function tests, quality of life questionnaires, asthma severity, peak flow measurements, and symptom diaries. After 3 months of either active SMT or sham SMT, the quality of life measurements improved and the asthma severity classification was lower in the treatment group.⁵³

Homeopathy

Homeopathy is becoming a popular treatment for both acute and chronic health problems and is thought to be one of most widely used CAM therapies. In India, there are over 200,000 registered practitioners, 182 colleges that teach homeopathy, and over 300 homeopathic hospitals.⁷ Homeopathy is classified as a drug therapy in the U.S. by the FDA, and in some countries has been integrated into the national healthcare systems. In the U.S. the qualifications of practitioners vary; some are trained exclusively in homeopathy, others are trained in homeopathy following professional qualification as a medical doctor, dentist, naturopath, or osteopathy.

Homeopathy is a therapeutic method using specific preparations of substances whose effects, when administered to healthy subjects, correspond to the manifestations of the disorder (eg, symptoms, clinical signs, pathologic states) in the individual patient. It is believed that the intended effect is to stimulate a healing response in the patient. A second principle in homeopathy is individualization of patients. This may be at the "whole person" level, or at a clinical level, especially in the treatment of acute conditions. The doses used in homeopathy range from those similar in concentration to some conventional medicines to very high dilutions containing no material trace of the starting substance. How the substances containing no material trace could have a specific physiological effect is not currently understood, and this is undoubtedly 1 source of skepticism about the claimed results of clinical trials in homeopathy.⁵⁴

Homeopathic remedies have been used to treat asthma. A Cochrane review examined 6 trials that were placebo-controlled and double-blinded, but noted they had variable quality in the conventional treatment of chronic asthma.⁵⁵ Because prescribed homeopathic treatments are usually individualized, no quantitative pooling of results was possible. There was no significant effect when measuring lung function, and the authors concluded that there is further need for observational data to document the different methods of homeopathic prescribing and patient response because, like in TCM, individualistic derived therapies are difficult to monitor using conventional randomized-control trials.⁵⁵ In a randomized double-blind placebo-controlled trial of individualized homeopathic remedies compared with placebo medication in 96 children with mild to moderate asthma, the role of homeopathic remedies as an adjunct to conventional therapies was studied. A childhood asthma questionnaire was used as the primary outcome measure in addition to lung function (peak flow measurements), medication use, symptom scores, days missed from school, asthma events, and adverse reactions. The study found that using classic homeopathic remedies showed no evidence of improving the quality of life or any other of the parameters measured.⁵⁶

Integrative Approach to Asthma Case Report

M.P. was an 8-year-old boy who was diagnosed as having asthma at 3 years old. He was hospitalized at that time for respiratory distress and bronchiolitis, but did not require further hospitalization. He recently moved to live with his grandmother after his parents were divorced. Since moving, his asthma became more difficult to control despite using his usual asthma medications. He was referred to an asthma specialist for evaluation.

His past history revealed that in the previous 6 months, M.P.'s asthma symptoms had increased, and he required 4 visits to the local urgent care clinic in the previous 2 months. The grandmother believed that the medications were too strong and had too many side effects especially increasing his appetite. On

questioning, no specific "triggers" were identified. On review of symptoms, it was found that M.P. coughed at night and could not run or play for extended periods of time without wheezing, so he no longer exercised. As a result, he watched television and played video games when not in school. His birth history was unremarkable; however, he was delivered via caesarean section. M.P. received multiple courses of antibiotics in the first 2 years of life due to recurrent ear infections. He did have a short hospitalization for a tonsillectomy and adenoidectomy for "allergies" and frequent ear infections at 4 years of age. Before moving, he was reported to be doing well. Now that he has moved, the grandmother noted that he was becoming overweight. His usual diet consisted of snack foods, carbonated beverages, and frequent stops at fast food restaurants.

His medications at the initial visit included fluticasone, 44 µg; meter dose inhaler, 1 spray using meter dose inhaler, twice a day; montelukast 5 mg tab, 1 tab every evening; albuterol meter dose inhaler (SABA), 2 sprays every 4 hours as needed for cough/wheeze and before exercise; and an over-the-counter cough syrup (dextromethophan), 2 tsp at night for cough. M.P. used his albuterol at least twice a day for the last 6-8 weeks. He did not use a spacer device with his inhaler medications. His immunizations were current, although he did not receive influenza vaccination the previous winter season. He had no known allergies to medications. His grandmother thought he may have hay fever because he was experiencing frequent sneezing, nasal congestion, and eye rubbing. Both M.P. and his sister were sent to live with their grandmother because of parental discord and an ongoing custody battle for both children. The grandmother had lived alone, had 1 indoor cat, and there was tobacco smoke exposure in the home. A review of M.P.'s family history revealed that M.P.'s father had asthma as a young boy, his mother had mild hay fever, and his sister had severe eczema when she was an infant.

M.P. stated he had difficulty breathing at night and chest tightness when running. He complained of becoming short of breath easily, even when walking up several stairs. He was discouraged because he enjoyed playing soccer but could not due to his breathing problem. He used his albuterol inhaler after running, but he continued to have wheezing. During his first clinic visit, he was anxious and appeared overweight. His vital signs included heart rate, 82; respiratory rate, 24; blood pressure, 105/56; and oxygen saturation, 98%, on room air. His height was 131 cm (75th percentile), weight was 41 kg (>95th percentile), and his body mass index was 24.1 kg/m² (>95th percentile). M.P.'s physical examination was normal except for clear nasal discharge and decreased breath sounds on auscultation of his lungs with a prolonged expiratory phase. When asked to take a deep breath and forcefully exhale, this precipitated a coughing episode. The rest of his physical exam was normal except for areas on his neck that were suspicious for acanthosis nigricans. During this visit, spirometry was obtained and showed moderately obstructed airways (decrease in FEV₁; see Figure 1) that normalized after 4 sprays of a bronchodilator (albuterol).

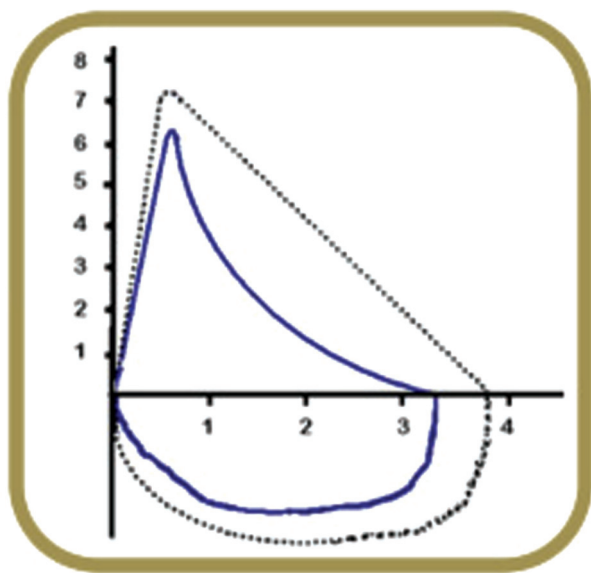


Figure 1. Typical spirometry illustrating the reduced flows per volume (solid line) in obstructive lung problems such as asthma. There is a “scooping” of the flow volume loop (dash lines being normal).

The assessment at the initial clinic visit was that M.P. had moderately persistent asthma that was poorly controlled. It was determined that he was using an inadequate dose of fluticasone for his degree of asthma severity, was not using proper technique (no spacer device), was overusing his albuterol, and was not using albuterol pre-exercise. It was also determined that there were new environmental triggers which caused an increase in symptoms including tobacco smoke exposure and possibly cat dander. The roles of his recent weight gain and stress from his parental discord in addition to living in an unfamiliar environment was also discussed as possible stressors. M.P. and his grandmother were reassured that, even though his lung function was abnormal on testing, his lung function normalized after using the bronchodilator medication (albuterol). During this visit, M.P.'s diet and lack of exercise with subsequent weight gain were discussed as possible causes contributing to his worsened asthma problems. In addition, M.P. had several laboratory tests completed including radioallergosorbent test (RAST) which returned positive for house dust mite (5.5 kU/L, normal < 0.35 kU/L) and cat dander (6.31 kU/L, normal < 0.35 kU/L). His total IgE was 244 kU/L (normal < 60 kU/L) which confirmed that allergies may be playing a role in his asthma symptoms. Hemoglobin A1C was 5.7 (normal < 6.0) to check for glucose intolerance.

A therapeutic asthma plan was developed for M.P. and was summarized in a written “action plan.” The role of all of his medications were discussed in detail and obstacles for his receiving his regular medications were

reviewed including the grandmother's concerns regarding side effects. The medications were changed: fluticasone was increased to 110 µg, 2 sprays twice a day using spacer device; montelukast was continued at 5 mg/day, and he was instructed on using his albuterol inhaler 15 minutes before exercise and with increased symptoms using the spacer device. His home environment was modified by removing the cat from the house, and not allowing any tobacco smoke in the house. The grandmother was instructed in reducing house dust mite exposure by covering M.P.'s mattress and pillow coverings. She was given discount coupons for purchasing these items.

In addition to reducing caloric intake and increasing exercise, M.P. and his grandmother received a detail lifestyle management plan. The family met with a registered dietitian (RD) to review his current diet; substituting the highly processed foods he was regularly eating with foods high in antioxidants (especially fruits), and ω-3 fatty acids (fish, dark green leafy vegetables, flaxseed oil) was suggested. The RD identified with M.P. and his grandmother which types of foods he would be willing to try and which of the less nutritious foods he was willing to avoid. As part of this overall plan, M.P. enrolled in martial arts (karate) with extra attention given to breathing control. During a subsequent visit 2 weeks later, he was taught simple relaxation techniques by the physician and asked to use this relaxation when he was feeling particularly anxious or upset. Lastly, both he and his sister were referred to a family counselor as were the mother and father. The grandmother and M.P. were integral in these decisions and understanding that the plan would be to decrease conventional medications as he clinically improved.

Upon return to the pulmonary clinic 3 months later, M.P. reported improved exercise tolerance, sleep pattern, and overall health. He now used his albuterol with spacer only before exercise and had not required this SABA for symptom control for 4 weeks. An Asthma Control Test (asthma questionnaire) was administered, and he was found to have excellent control of his asthma. His repeat spirometry was normal and a repeat immunoglobulin E had decreased to 115 kU/L. On exam, he had normal lung findings and he had lost 0.8 kg; his height was unchanged. M.P. and his grandmother stated his diet consisted of more fruits but he did not care for green leafy vegetables. He ate fish (salmon, sardines, herring) twice weekly, and the family had reduced their fast food intake to 1 outing per week. He no longer drank carbonated soft drinks.

Because he had improved in all parameters of asthma care, his fluticasone was reduced to the 44 µg strength, still using 2 sprays twice a day with a spacer. His montelukast was continued and he was started on pycnogenol as an anti-inflammatory herbal remedy starting at 30 mg once daily. He was evaluated every 3 months, and after 9 months was no longer requiring the ICS (fluticasone). M.P. and his grandmother believed they now understood

asthma and realized that stress and environmental triggers had played a significant role. The 1 area that they believed was the most helpful in improving his overall asthma control was the changes in lifestyle including diet, exercise, relaxation, and family counseling. His grandmother stated that by reviewing the asthma action plan regularly, discussing short- and long-term goals, and being part of the decision-making process helped her care for M.P. believed that knowing when and how to take his medications correctly and being able to control his environment in addition to his improved self-esteem, because now he was active, was most important in his feeling better and using fewer medications.

Summary

CAM and conventional medicine in combination may be used together in the treatment of asthma in children. This "integrative medicine" approach may have success in reaching the objectives of therapy: reducing symptoms, preventing exacerbations, and promoting a healthy lifestyle with minimal adverse side effects especially when using ICS. However, there is no research or consensus on the CAM therapies which should be recommended in addition to the usual conventional therapies. It is not clear which CAM therapies have advantages over others and which CAM therapies may actually even cause harm either using with conventional asthma treatments or alone. The safety and efficacy of every conventional or CAM therapy should be discussed with the patient and the family, and be frequently reviewed to ensure that care is optimal. With the complex interaction of genetic influences and environmental exposures playing a role in childhood asthma, further studies using CAM therapies with conventional treatments are warranted, but the discussion and case presented demonstrate that using this integrative approach may result in improved asthma control.

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