

Pediatric Allergic Rhinitis: the Stepwise Treatment Approach

Margaret T. Redmond, MD^{1,2}

Kara J. Wada, MD^{1,2}

David W. Hauswirth, MD^{3,*}

Address

¹Division of Infectious Disease and Immunology, Nationwide Children's Hospital, Columbus, OH, USA

²Division of Pulmonary, Allergy, Critical Care and Sleep Medicine, The Ohio State University, Columbus, OH, USA

³Section of Allergy, Nationwide Children's Hospital, Columbus, OH, USA
Email: davidhauswirth@yahoo.com

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Opinion Statement

Treatment of allergic rhinitis in children requires a thoughtful, stepwise approach. Before considering medication for rhinitis, possibly chronic medication, you must (1) confirm disease based on symptoms or testing for offending allergens, (2) implement environmental controls when possible, (3) understand how allergy medication will affect children, and (4) recognize the need to use the minimum amount of medicine necessary to treat symptoms. Special attention to the impact of medication on school performance and social interactions is important when treating children. For intermittent symptoms, an oral antihistamine should be tried first. Chronic symptoms will respond best to a topical nasal steroid spray. Spending the time to figure out what most troubles the child will focus therapy (such as an antihistamine eye drop when ocular itching is a primary symptom) and prevent use of unnecessary medication. Moving past medication to immunotherapy is an important next step as we look for ways to change the natural course of atopic disease. There are now multiple approved forms of immunotherapy in the USA; this should allow a tailored approach to treating symptoms that have progressed beyond pharmacologic therapy. These layers of therapy, environmental control, pharmacologic management focused on bothersome symptoms, and immunotherapy, naturally allow for escalation of treatment with increasing symptoms. Working with the parents is imperative to fully understand the impact symptoms are having on the child and to achieve compliance with medications. This combined, stepwise approach will lead to good relief for the child and satisfaction among both parents and treating physician.

Introduction

Sneezing, rhinorrhea, conjunctivitis, and nasal congestion are all common symptoms of a common pediatric condition, allergic rhinitis. Prevalence rates range between 8.4–19.1 % of children in the USA [1, 2]. Despite being common, allergic rhinitis in children can have a variety of different manifestations and treatment options. Symptoms can be seasonal or perennial; parents often wish to minimize the amount of medicine they give their children, and children can react differently than adults to

medicines, all of which can alter treatment recommendations. Studies have shown that allergic rhinitis adversely affects quality of life in children, including a decrease in school performance, lower exam scores, and increased sleep disturbance [3, 4]. In order to be effective, management strategies for allergic rhinitis require a thoughtful approach which may include environmental controls, pharmacologic therapies, non-pharmacologic therapies, and allergen-specific immunotherapy.

Treatment

Lifestyle

Avoidance

The diagnosis of allergic rhinitis in children often begins with a detailed history and physical exam followed by skin prick testing or serum-specific IgE testing. Identification of offending allergens is necessary and makes avoidance strategies possible, making this an important component of therapy. Repeated exposure to outdoor allergens has been shown to increase symptoms as the pollen season progresses, an effect known as priming [5]. Open windows and whole house attic fans increase the pollen counts inside the home and use of air conditioners significantly decreases pollen counts in the home [6]. The 2008 American Academy of Allergy Asthma and Immunology allergic rhinitis practice parameter recommends that patients be instructed to avoid being outside during parts of the day when the pollen count is high (early morning and evening) [7]. Multiple meteorological factors including wind speed, wind direction, humidity, and recent rainfall contribute to pollen counts and make it difficult to predict when pollen counts will be elevated [8]. Physical barriers like nasal filters and occlusive sunglasses have shown symptom benefit in a research setting, but are not currently recommended or practical for daily use [9, 10]. While it is not feasible to completely avoid pollens, a few recommendations can decrease a child's pollen exposure. These include keeping windows shut in the home and in the car during the pollen season, avoiding being outside during the high pollen times of the day if possible, changing clothes when coming in from being outdoors, and rinsing off both hair and body after being outside, especially before going to bed to keep pollens out of the bedding.

While avoidance of outdoor pollen can help limit symptoms, the impact of allergen avoidance for perennial allergens is less clear. It is much more difficult to avoid perennial allergens. Approximately 80 % of homes and 85 % of day care centers have detectable dust mite [11]. Dust mites are not found in areas of the USA with low ambient humidity and newer homes typically have lower dust mite levels [12]. Dog and cat allergens are present in the community and in homes, even without a pet in a home

[13, 14]. Families are reluctant to remove an animal from the home, and it can take up to 6 months to have a meaningful decrease in the amount of pet allergen after pet removal from a home. Recommendations for decreasing pet allergen exposure if the pet is to remain in the home include excluding the animal from the bedroom at all times, washing hands after handling the pet, washing the pet twice weekly, and use of HEPA filters in bedroom [15]. HEPA filters are effective in dramatically reducing levels of cat allergen in a home; however when studied, this had little impact on rhinitis symptoms [16]. There is an increase in the odds of cockroach allergen being present in a home when water leaks or visible cracks in the walls of the home are present, and patients are often not aware of their exposure [17].

Dust mite avoidance recommendations included in rhinitis practice parameters include reducing humidity in the home to below 50 %, HEPA vacuuming and use of acaricides on carpets that cannot be removed, use of encasements on mattresses and pillows, and frequent washing of bedding. Dust mite avoidance is commonly recommended as part of a comprehensive allergy management strategy; however, these recommendations face some criticism as the evidence supporting their effectiveness is lacking. These guidelines have been more rigorously studied in asthma than allergic rhinitis. In children with asthma, comprehensive dust mite avoidance in combination with tobacco avoidance and regular assessment was effective, but single method dust mite avoidance strategies were not effective [18, 19]. The Allergic Rhinitis and its Impact on Asthma (ARIA) and Global Initiative for Asthma (GINA) asthma guidelines no longer recommend single intervention dust mite avoidance for patients; however, the ARIA guidelines do suggest a multifaceted approach for inner city patients with asthma [21, 22, 20•]. There are fewer studies evaluating the efficacy of dust mite avoidance in allergic rhinitis, but a Cochrane systematic review, published in 2012, concluded that there was no evidence to support isolated use of bed covers; however, there was a trend showing that interventions which significantly reduced mite load, provided some symptom relief [23]. Many in the field have raised concerns about conclusions which do not support dust mite avoidance in allergic rhinitis [24, 25]. However, comprehensive dust mite avoidance can be both expensive and time consuming and this may not be cost-effective considering the modest benefit for patients. Furthermore, resources are possibly diverted from more effective therapies, thus the ARIA and GINA asthma guidelines conclude that without clear benefit, these should not be recommended for asthma patients due to the potential for diversion of resources [21, 22]. However, many practitioners still make this recommendation for allergic rhinitis based on patient report of benefit and for those seeking a non-pharmacologic approach to treatment.

Pharmacologic Treatment

Given the impractical nature of complete allergen avoidance and the lack of good evidence to support this approach, most patients require some form of pharmacologic therapy for treatment of their allergic rhinitis symptoms.

Table 1. Antihistamines used in pediatric allergic rhinitis

Generic name (brand name)	Formulation	Recommended dosage
First generation:		
Diphenhydramine (Benadryl, Diphenhist, PediaCare Children's Allergy)	Syrup: 12.5 mg/5 ml Tablet: 25 mg, 50 mg	Not recommended for infants/neonates 1–6 years: 6.25–12.5 mg q4–6 h 6–12 years: 12.5–25 mg q4–6 h; MAX dose: 150 mg/day >12 years: 25–50 mg q4–6 h; MAX dose: 300 mg/day
Chlorpheniramine (Aller-Chlor, Chlo-Amine, Chlor-Trimeton, Polaramine, Teldrin)	Syrup: 2 mg/5 ml Tablet: 4 mg	6–11 years: 2 mg q4–6 h; MAX dose: 12 mg/day ≥12 years: 4 mg q4–6 h; MAX dose: 24 mg/day
Brompheniramine (Ala-Hist, J-Tan, Veltane)	Syrup: 1 mg/1 ml, 2 mg/5 ml capsules	2–6 years: 1 mg q4–6 h 6–12 years: 2 mg q4–6 h ≥12 years: 4 mg q4–6 h
Clemastine (Tavist)	Syrup: 0.5 mg/5 ml Tablet: 1.34 mg, 2.68 mg	6–12 years: 0.5 mg BID, MAX dose: 3 mg/day ≥12 years: 2.68 mg 1–3 times daily, MAX dose: 8.04 mg/day
Carbinoxamine maleate (Karbinal ER)	Syrup: 4 mg/5 ml	2–3 years: 3–4 mg q12 h 4–5 years: 3–8 mg q12 h 6–11 years: 6–12 mg q12 h >12 years: 6–16 mg q12 h
Second generation:		
Cetirizine (Zyrtec)	Syrup: 5 mg/5 ml Tablets: 5, 10 mg	6–12 months: 2.5 mg QD 1–5 years: 2.5–5 mg QD ≥6 years: 10 mg QD
Desloratidine (Clarinx)	Syrup: 2.5 mg/5 ml Tablet: 5 mg	6–11 months: 1 mg QD 1–5 years: 1.25 mg QD 6–11 years: 2.5 mg QD ≥12 years: 5 mg QD
Fexofenadine (Allegra)	Syrup: 30 mg/5 ml Tablet: 30 mg, 60 mg, 180 mg	2–11 years: 30 mg BID ≥12: 60 mg BID or 180 mg QD
Loratadine (Claritin)	Syrup: 5 mg/5 ml Tablet: 10 mg	2–5 years: 5 mg QD ≥6 years: 10 mg QD
Third generation		
Levocetirizine (Xyzal)	Syrup: 2.5 mg/5 ml Tablet: 5 mg	6–11 years: 2.5 mg QD ≥12 years: 5 mg QD

Oral Antihistamines

First-line therapy for pediatric patients with intermittent allergic rhinitis remains oral antihistamines [21, 26, 27]. They are a safe and effective option for pediatric patients [28]. First generation antihistamines used in the treatment of pediatric allergic rhinitis include diphenhydramine, chlorpheniramine, brompheniramine, clemastine, and carbinoxamine maleate (Table 1) [26].

Unfortunately, their ability to readily cross the blood brain barrier results in significant side effects including sedation and difficulty with learning [29–31]. Due to significant sedation, concomitant use of other sedating medications should be avoided [32–34]. Paradoxical reactions include excitation, restlessness, insomnia, or seizures [30]. Additionally, anticholinergic side effects including dry mouth, dry eyes, blurred vision, and urinary retention can also be problematic [31].

Second generation antihistamines are preferred given their comparable efficacy with improved side effect profile and longer duration of action. These are essentially non-sedating and include cetirizine, loratadine, fexofenadine, and desloratadine. Several are approved for children as young as 6 months of age (Table 1).

A third generation antihistamine, levocetirizine, is an additional treatment option but was not found to be any more efficacious than cetirizine in a randomized double blinded placebo controlled study of children with severe perennial allergic rhinitis [35]. In a small double blinded, placebo controlled, cross over study, patients did not demonstrate any significant difference in reports of sedation comparing cetirizine, levocetirizine, and placebo [36].

Intranasal Antihistamines

Azelastrine and olopatadine are second generation antihistamines administered intranasally [37, 38]. Intranasal antihistamines (INH), as well as oral antihistamines, can be utilized on an as needed basis given their fast onset of action. Within minutes, they relieve sneezing, nasal itching, congestion, and postnasal drip [39, 40]. They are limited by their bitter taste that affects up to 20 % of patients and can cause drowsiness and fatigue in some patients. They have only been studied and approved for use in children over the age of 12.

Ocular Medications

Antihistamine eye drops, alone or in combination with mast cell stabilizers, can be useful for patients complaining primarily of ocular allergy symptoms. Additionally, they can be added on to a medication regimen if ocular symptoms are not well controlled. They are generally well tolerated, and most are approved in patients age 3 and older [41]. Antihistamine-based treatments include levocabastine (Livostin®) and emedastine (Emadine®), which are dosed one to four times daily. Combination products offer the advantage of twice daily dosing with more of a prophylactic effect. Combination products include olopatadine (Patanol®), ketotifen (Zaditor®), epinastine (Elestat®), azelastrine (Optivar®), and bepotastine (Bepreve®). Newer once daily formulations of olopatadine (Pataday®, Pazeo®) and alcaftadine (Lastacraft®) are available. Ocular antihistamines are an add-on to systemic therapy and provide specific symptom relief and limit escalation in systemic therapy to control ocular symptoms.

Intranasal Corticosteroids

Intranasal corticosteroids (INS) are the most effective pharmacologic treatment of allergic rhinitis [43, 42••]. They are effective in relieving congestion, rhinorrhea, nasal itch, and postnasal drip and are recommended for moderate to severe symptoms. Intranasal steroid formulations approved for use in

Table 2. Nasal sprays used in pediatric allergic rhinitis

Generic name (brand name)	Formulation	Recommended dosage
Corticosteroids		
Fluticasone propionate (Flonase)	50 µg/spray	>4 years: 1–2 sprays each nostril QD
Fluticasone furoate (Veramyst)	27.5 µg/spray	>2 years: 1–2 sprays each nostril QD
Mometasone (Nasonex)	50 µg/spray	2–12 years: 1 spray each nostril QD >12 years: 2 sprays each nostril QD
Beclomethasone (dry powder) (Qnasal)	80 µg/spray	>12 years: 2 sprays each nostril QD
Beclomethasone (Beconase)	42 µg/spray	>6 years: 1–2 sprays each nostril BID (max 4 sprays each nostril BID)
Ciclesonide (dry powder) (Zetonna)	37 µg/spray	>12 years: 1 spray each nostril QD
Ciclesonide (Omnaris)	50 µg/spray	>6 years: 2 sprays each nostril QD (seasonal) >12 years: 2 sprays each nostril QD (perennial)
Budesonide (Rhinocort)	32 µg/spray	6–12 years: 1–2 sprays each nostril QD >12 years: 1–4 sprays each nostril QD
Flunisolide (Nasalide/Nasarel)	25/29 µg/spray	6–14 years: 2 sprays each nostril BID >14 years: 2 sprays each nostril BID/TID (max 8 sprays each nostril QD)
Triamcinolone acetonide (Nasocort)	55 µg/spray	2–11 years: 1 spray each nostril QD >12 years: 1–2 sprays each nostril QD
Antihistamines		
Azelastine (Astelin)	137 µg/spray	5–11 years: 1 spray each nostril BID ≥12 years: 2 sprays each nostril BID
Olopatadine (Patanase)	665 µg/spray	6–11 years: 1 spray each nostril BID ≥12 years: 2 sprays each nostril BID
Combination		
Azelastine/fluticasone (Dymista)	137 µg/50 µg/spray	≥12 years: 1 spray each nostril BID

pediatric patients include beclomethasone, budesonide, ciclesonide, flunisolide, fluticasone furoate, fluticasone propionate, mometasone furoate, and triamcinolone acetonide (Table 2) [37]. In pediatric patients, the most commonly cited parental concerns are possible side effects due to systemic absorption including suppressed growth and hypothalamic-pituitary-adrenal (HPA) axis suppression. Of the medications studied in pediatric patients, mometasone furoate, fluticasone propionate, triamcinolone acetonide, and budesonide have not demonstrated any adverse effects on cortisol levels, the HPA axis or growth [44–46]. A 0.9-cm height difference was demonstrated in pre-pubertal children using intranasal beclomethasone dipropionate over a 1-year time frame [47].

Approximately 5–10 % of patients may complain of local side effects, which may include irritation of the nasal mucosa and epistaxis. Patients with side effects can try dry aerosol preparations of beclomethasone and ciclesonide as an option if other, aqueous, preparations are not tolerated [48, 49]. A combination

spray, which includes azelastine hydrochloride and fluticasone propionate (Dymista®), is an option for patients age 12 and older [39]. Adverse effects are comparable to the individual components and use of a single product may improve compliance [37]. The combination of nasal corticosteroid and oral antihistamine does not appear to demonstrate benefit over nasal corticosteroid alone [50]; however, the combination of both INH/INS does offer improved symptom control over each product individually (product labeling data). Oral antihistamines can be used as part of a combination used for treatment of non-nasal allergic symptoms.

Systemic Corticosteroids

Systemic corticosteroids such as prednisone and prednisolone are reserved for very severe symptoms, as a rescue measure. They should be used at the lowest possible dose and for the shortest duration possible [51]. There is a lack of evidence to guide providers, but if necessary prednisolone or prednisone is dosed at 0.5–1 mg/kg/day up to a maximum of 40 mg daily for 5 days. Short duration steroid use does not always require a tapering dose. Injections of depot corticosteroids are not recommended given the risk of significant side effects including reports of avascular necrosis [51, 52].

Nasal Decongestants

Both oral and topical decongestants are available over the counter in the USA. These products can help alleviate nasal congestion, but are not effective in treating itching, sneezing, and nasal drainage [21, 37]. Oral decongestants carry a greater risk of systemic side effects including hypertension, cardiac arrhythmias, palpitations, tremor, and CNS excitation. These medications are strictly contraindicated in patients with underlying heart disease, hyperthyroidism, glaucoma, diabetes mellitus and with MAO inhibitor usage [31]. Oral decongestants are often used in combination with oral antihistamines for short duration therapy. These products will offer some improved symptom control over antihistamine alone. If used longer than 3 to 5 days, topical decongestants also run the risk of rebound congestion and stuffiness, which can result in rhinitis medicamentosa [26, 37]. These medications should not be used for control of chronic symptoms or as part of an ongoing management program.

Leukotriene Receptor Antagonists

Leukotriene receptor antagonists (LTRA) such as montelukast or zafirlukast are another option for allergic rhinitis in patients 6 months and older. These can be given individually or with a second generation antihistamine; although, the evidence supporting the superiority of the combination are limited [53]. In a study comparing montelukast with cetirizine, both were efficacious but cetirizine was superior with nasal itch control whereas sleep was improved with montelukast [54]. Additionally, LTRA should be considered in patients with a concomitant diagnosis of asthma [55]. LTRA are typically well tolerated, but there have been reports of agitation, depression, hallucinations, drowsiness, and seizures [56].

Nasal Anticholinergics

Topical ipratropium bromide has not been well studied in the pediatric population but is occasionally used for refractory rhinorrhea. It is approved for

children 5 years and older. It can be helpful with gustatory rhinitis and rhinitis associated with exposure to cold air. Patients may develop nasal irritation, crusting, and mild epistaxis with use [7, 57].

Nasal Mast Cell Stabilizers

Cromolyn sodium nasal spray has fallen out of favor due to its short duration of action and minimal effect on congestion. It is best used prior to development of symptoms and needs to be used four times daily, thus is not practical for most patients and families [57, 58].

Immunotherapy

Specific allergen immunotherapy is a treatment option for pediatric patients. Immunotherapy indications include uncontrolled rhinitis symptoms, coexisting rhinitis and asthma, rhinitis with proven sequelae, children with intolerance to medication, or when there is a desire to decrease long-term medication use. There are currently two FDA-approved forms of immunotherapy available in the USA for children, subcutaneous injections (SCIT), and sublingual tablets (SLIT). Allergen immunotherapy is indicated for children with allergic rhinitis sensitive to aeroallergens confirmed through either skin prick testing or serum-specific IgE elevation [59]. In the USA, there are currently two grass pollen sublingual tablets that are FDA approved; Grastek® approved in children from 5 years of age and Oralair® approved from 10 years of age. Grastek® is a single grass (Timothy grass) pollen tablet that relies on northern pasture grass cross reactivity, and Oralair® contains five grass pollens (Sweet Vernal, Orchard, Perennial Rye, Timothy, and Kentucky Blue Grass) [61, 60•]. Both tablets can be dosed pre and co-seasonally, beginning 12 weeks prior to the grass season and continuing daily through the end of the grass pollen season. Grastek® may be dosed continuously for three consecutive years for sustained effectiveness after discontinuation (package insert). Ragweed SLIT (Ragwitek®) is available but is only approved for adults 18 years of age and older. Dust mite SLIT is currently in development, and favorable safety data in children as young as 12 were recently published, and a dust mite product may be available in the USA within the next few years [62•]. Subcutaneous immunotherapy has been used with good results for well over 100 years in allergic rhinitis with efficacy demonstrated in multiple trials for both mono- and poly-sensitized patients. The SLIT option is newer in the USA (used for decades in Europe) and is ideal for patients who are mono-sensitized, children with needle phobia, or patients unable to receive injections in a healthcare setting. SLIT can safely be administered at home; the initial dose should be given in a physician's office (with 30 min of observation) with self-injectable epinephrine available at home.

There are multiple benefits of immunotherapy for pediatric patients, and these include improvement in control of symptoms (rhinitis and conjunctivitis), prevention of the development of asthma, and reduction in risk of developing further allergic sensitizations [63–67]. A meta-analysis has shown an improvement in symptom scores of 73 % in SCIT and 49 % in SLIT and a reduction in medication use of 57 % in SCIT and 32 % in SLIT [68, 69]. Both SCIT and SLIT have been shown to have benefit in both the short and long term, even over a decade after completing therapy [70–72]. A recent review in

pediatrics demonstrated that both SCIT and SLIT therapies are safe [73]. Efficacy and safety of allergen immunotherapy have been shown in children under 2 years of age, but historically immunotherapy has been given to children under 5 years of age only for cases of severe allergic reactions or anaphylactic venom reactions [59, 74, 75].

Local reactions are common in both SCIT and SLIT. Local reactions in SCIT involve erythema, swelling, itching, and tenderness at the injection site. These reactions occur in 71 % of patients, though 87 % of these patients rate the reactions as not bothersome [76]. In SLIT, local reactions are typically mouth itching and swelling and occur in 46 % of patients [77]. These reactions can be bothersome, but only 4 % of patients discontinued therapy due to local reactions [77]. The risk of systemic reaction with conventional immunotherapy dose schedules is estimated to be 0.2 %, though the risk has been reported at 34 % when using a rush immunotherapy schedule [78, 79]. Fatality with a systemic reaction following SCIT injection is possible and has been estimated at one fatality in 2.5 million injections [80, 81, 82••]. Though recent data indicates that this rate may be decreasing, possibly secondary to better screening of patients with known risk factors like uncontrolled asthma and earlier epinephrine administration [83]. Sublingual tablets have a lower incidence of systemic reactions; however, there is still a risk of anaphylaxis (black box warning) and patients are prescribed epinephrine as a precaution during home administration of SLIT tablets. [72].

Omalizumab is not indicated for the treatment of allergic rhinitis in children, however has been studied as an adjunct with subcutaneous immunotherapy in patients who are otherwise unable to tolerate immunotherapy due to systemic reactions [84]. The addition of omalizumab to immunotherapy does not alter either the short-term or long-term efficacy and benefit of immunotherapy [85].

In addition to the benefits in symptom control, immunotherapy in children was associated with a 30 % reduction in total health care costs, inclusive of immunotherapy costs, that was evident 3 months after initiating therapy [87, 88, 86•]. Immunotherapy should be considered for the treatment of allergic rhinitis in all children over the age of 5 years with allergic rhinitis who have symptoms despite pharmacologic management, wish to decrease their use of medications, who have a family history of asthma but have not yet developed asthma, or in children younger than 5 years old with severe symptoms that do not improve with medical management.

Other Treatments

Saline Irrigation

Saline irrigation using ready-made sprays, neti pots, or other various irrigation devices is a non-pharmaceutical option for the treatment of rhinitis symptoms. This option has been shown to reduce symptoms and improve the effect of nasal steroids [51, 89]. Hypertonic saline solutions may be more effective, especially in patients with chronic sinusitis, but are not as well tolerated [90, 91]. Isotonic saline use has demonstrated faster resolution of acute upper respiratory illnesses in children [92]. Double

blind placebo controlled studies in children with allergic rhinitis are lacking but given the low risk and potential for reward, a trial of saline should be considered along with traditional therapies.

External Nasal Dilator

External nasal dilators, more commonly known by their trade name, Breath-Right® strips, increase the cross-sectional area of the nasal airway. These devices were evaluated in children with and without nasal congestion [93]. They demonstrated subjective efficacy but no objective improvement in those children with symptoms of congestion.

Local Honey

Only one study has evaluated the effects of daily local raw honey on allergic rhinitis comparing it to regular honey and a placebo. No differences were found between treatment groups [94].

Other Complementary Treatments

Complimentary therapies such as acupuncture, homeopathy, and herbal remedies such as butterbur are not recommended in the treatment of children with allergic rhinitis [21]. A meta-analysis investigating the effectiveness of acupuncture in the treatment of allergic rhinitis in adults demonstrated decreased nasal symptom scores, medication scores, and IgE levels, but additional studies have not demonstrated cost-effectiveness of treatment [95, 96].

Butterbur (*Petasites hybridus*) is a shrub used by some in the treatment of allergic rhinitis. In one systematic literature review of trials in adults, it appears to be as effective as antihistamines [97]. Unfortunately, it has not been studied in children. Additionally, raw, unprocessed butterbur contains pyrrolizidine alkaloids, which can cause liver damage. Butterbur can also cause allergic reactions in those who are ragweed allergic [98].

The efficacy and safety of essential oils in the treatment of pediatric allergic rhinitis have not been investigated. Lavender oil inhalation has been investigated in a mouse model of asthma with some promising initial results, but much work still needs to be completed before recommending usage in pediatric patients [99]. Unfortunately, there have been numerous case reports of contact dermatitis as the result of essential oil use and routine patch testing may not identify the potential allergen [100].

Conclusions

The treatment of pediatric allergic rhinitis must be focused on symptom management and thoughtful use of medication. This common condition can have a variety of effects on children including missed school, poor sleep, and impaired learning. Environmental controls will add to therapy, but alone are not sufficient to control symptoms. Nonetheless, these should still be part of any treatment plan as failure to control the environment may decrease efficacy of other therapies. Oral, ocular, or nasal antihistamines are best used for intermittent or short duration seasonal symptoms. Nasal steroids have the most proven efficacy for chronic allergic nasal symptoms. Failure of medication, desire to decrease long-term medication use, or side effects of treatment can be

approached with immunotherapy (sublingual or subcutaneous), which will allow for modification of atopic disease. Non-pharmacologic or complementary therapy may be sought by parents, and practitioners need to understand the benefits and drawbacks of these options. This thoughtful, methodical approach will allow for patient participation in treatment and optimal outcomes for children with allergic rhinitis.

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Compliance with Ethical Standards

Conflict of Interest

Dr. Margaret T. Redmond, Dr. Kara J. Wada, and Dr. David W. Hauswirth declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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