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Shifts in Asthma Evaluation and Management During COVID-19

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Abstract

Purpose of Review The comprehensive management of asthma has historically relied on in-person visits to obtain a detailed history, thorough physical exam, and diagnostic and monitoring tools such as pulmonary function testing. The COVID-19 pandemic has posed numerous challenges to adequately utilizing these strategies. Despite these limitations, telemedicine has provided an important means to deliver asthma care. In this review, we discuss how these challenges have created paradigm shifts in not only the clinical aspects of asthma management, but also in patient attitudes and physician–patient relationships.
Recent Findings Different strategies have been suggested to address asthma during COVID-19. Telemedicine has taken on an important role during the pandemic. The emphasis on asthma questionnaire use, education regarding lapsed asthma control, and as-needed oral corticosteroid courses have proven to be important instruments in the remote management of asthma. Overall, asthma exacerbations have decreased during this time. This is thought to be due to a variety of factors such as decreased exposure to common triggers.
Summary Although the COVID-19 pandemic significantly limited an allergist's ability to provide conventional comprehensive asthma management, we also found that patient outcomes have actually improved. In addition to the decreased exposure to asthma triggers, this may also be an effect of increased patient ownership of their asthma, and subsequent improved therapeutic alliance.

Introduction

Asthma is a chronic condition often managed in the outpatient setting. The Centers for Disease Control and Prevention estimates a prevalence of 7% in adults and 8% in children in the USA [1]. The outpatient management of asthma is dependent first upon the adequate diagnosis and characterization of a patient's asthma. This can be accomplished through a combination of taking a history, physical examination, laboratory tests, allergy testing, and the use of pulmonary function testing. Once diagnosed, a treatment regimen can be personalized in accordance with asthma severity, underlying comorbidities, and patient preferences. Historically, inhaled corticosteroids with or without long-acting bronchodilators have been the mainstay of asthma management. They continue to remain an important part of management; however, non-inhaler therapies now play a prominent role as well. These include antileukotrienes, allergen immunotherapy, biologics, and oral steroids as needed. Apart from these therapeutics, adequate treatment of asthma includes management of comorbidities such as allergic rhinitis, atopic dermatitis, nasal polyposis, gastroesophageal reflux, obesity, vitamin D deficiency, and obstructive sleep apnea. Close follow-up with attention to adherence is crucial [2, 3•, 4••]. Prior to the COVID-19 pandemic, in-person visits served a regular part of the ongoing assessment, evaluation, and management of asthma. Office spirometry, pulse oximetry, and the physical exam were incorporated into the evaluation of the patient's level of control of their asthma.

The onset of the COVID-19 pandemic brought new challenges and questions to asthma management. In this article, we discuss these specific challenges as it relates to the diagnosis and management of asthma, subsequent changes to our practice, and implications going forward.

Severe asthma and the COVID-19 pandemic

To date, studies have not indicated that asthma increases morbidity or mortality in COVID-19 disease. However, recent usage of oral corticosteroids was noted to be a risk factor for COVID-19 related death [4••, 5, 6]. Thus, prevention of asthma exacerbations should be emphasized. Frequent evaluation of corticosteroid-dependent patients should be done, with the goal of reducing excessive oral corticosteroid use. During a pandemic, it is crucial to limit emergency room visits to minimize potential COVID-19 exposure, and allow medical resources to be directed toward COVID-19 care. To this end, it is important to develop strategies not just to treat severe asthma exacerbations, but also to optimize control before the point of medical urgency. Therefore, counseling and preventative education play an essential role in the management of asthma patients, particularly those with severe, uncontrolled disease and a history of frequent healthcare utilization.

Telemedicine consults

The increase of telemedicine consults during COVID-19 has offered the safety and convenience of managing patients remotely. However, this approach limits the conventional in-person management of asthma. Specifically, objective assessments such as spirometry, peak expiratory flow, fractional exhaled nitric

oxide measurement, pulse oximetry, and detailed lung auscultation cannot be performed.

To compensate for the lack of these tools, standardized questionnaires like the Asthma Control Test are helpful for repeated remote assessments [7] In addition, patients can be given guidelines to check in via telemedicine, such as if their home peak flow measurement drops below 20% of baseline, or if they use their rescue inhaler more than twice a week consistently. Asthma action plans can also provide specific guidelines on when to seek in-person care via the office or emergency room. In our practice, we have found that the Asthma Control Test, even if seemingly subjective, has been a fairly useful assessment of the patient's level of control over time.

Patients can also be given oral corticosteroids to be initiated if needed at the onset of an exacerbation. While in the pre-COVID-19 era we did not favor this strategy due to the concern for over-usage of corticosteroids, we prescribed more oral corticosteroids "on hand" in an effort to prevent urgent care visits, assuage anxiety, and minimize panic during after hours and weekends. This relies on trust, communication, and a solid patient-physician relationship. We have found that taking the time to explain the adverse effects of systemic corticosteroids, along with counseling of when they should be used, has been effective in limiting corticosteroid over-usage. This has led to an overall stronger rapport between the physician and the patient.

Even before the onset of the pandemic providers have utilized telemedicine specifically in asthma management. One study directly compared in-person management against telemedicine [8]. In this case, telemedicine visits specifically utilized digital stethoscopes and a telefacilitator who performed diagnostic testing as in spirometry. The study examined both patient outcomes utilizing asthma questionnaires and patient satisfaction. Both groups had small statistically insignificant increases in asthma control, with the majority of telemedicine patients reporting that they were satisfied with the care that they had received. In summary, telemedicine was found to be non-inferior to in-person management in this study. One recent meta-analysis examining the comparison of in-person visits with telemedicine visits was also identified in our literature search. In one analysis a combined case management model involving a hybrid of in person and telemedicine management was associated with improved asthma control and patient satisfaction compared to usual care [9].

Our literature search did not reveal any studies that compared telemedicine visits with in-person visits that occurred in the midst of the COVID-19 pandemic. However, some points are worth mentioning. To begin, asthma outcomes were noticeably improved in children in particular during the COVID-19 pandemic. In one electronic healthcare database review asthma outcomes in children 1 year prior to the onset of the pandemic and asthma outcomes 1 year after the onset of the pandemic were compared [10]. Interestingly, despite a substantial increase in telemedicine usage among those analyzed, asthma outcomes were generally improved during the pandemic. For example, the asthma exacerbation rate prior to the pandemic was 12.7%, whereas in the midst of the pandemic it was noted at 3.2%. Apart from exacerbations, the number of asthma-related outpatient encounters, emergency department visits, hospital stays, and antibiotic courses prescribed were

significantly less in asthmatics in the midst of the pandemic compared to prior. Aside from outcomes asthmatic patient satisfaction also appears to be rather favorable during the pandemic. In one study which utilized patient satisfaction surveys, patients nearly universally recommended video visits and applauded the practicality of video visits in comparison to in-person encounters [11].

In our experience in our general allergy clinics telemedicine visits have remained important in asthma management. Now, nearly 2 years into the midst of the pandemic, our offices are still utilizing telemedicine for approximately a quarter of all encounters. Of those visits, approximately a quarter are scheduled for the care of asthmatics. Patients routinely cite the practicality and ease of telemedicine visits as a positive, and we suspect that telemedicine will remain a cornerstone of our practice even beyond the pandemic. In practice, we dissuade poorly controlled asthmatics from heavily utilizing telemedicine given the importance of routine pulmonary function testing in these patients. We also prefer that new patient evaluations be completed in person first together with consideration of pulmonary function testing and imaging procedures. Table 1 lists a series of strategies that our clinics utilized to manage asthma during the COVID-19 pandemic. Other practices have implemented similar changes which include asthma questionnaires, peak flow monitoring, diary cards, and symptom recording applications [12].

Asthma comorbidities

Another key aspect of asthma management is recognition and management of comorbidities. These include atopic as well as non-atopic conditions.

On initial assessment of an asthma patient, physicians should evaluate for a history of atopy including allergic rhinitis, sinus disease, prior sinus

Table 1 Asthma management strategies utilized during telemedicine encounters in the COVID-19 pandemic

The Asthma Control Test was administered to the patient during the telemedicine visit
If appropriate, patients were provided with a peak flow meter for objective monitoring at home
Indicators of poor control including a 20% decrease in baseline ambulatory peak flow measurement and increased rescue inhaler utilization were reviewed in detail
On-hand oral corticosteroid courses were prescribed to be used if needed in an effort to decrease urgent care and emergency care utilization in selected patients
Internet links to reputable education resources and videos demonstrating proper inhaler and spacer technique were included in the patient's electronic after visit summary
Asthma Action Plans were made available in the patient's electronic after visit summary
Address comorbidities that may influence asthma control including allergic rhinitis, eczema, and obesity
If able, patients on biologic therapies were transitioned from in-office administration to home administration
Ensure patients' vaccinations are current to decrease the risk of infectious respiratory illness
In the case of children with a history of wheezing and a questionable diagnosis of asthma, the use of the Asthma Predictive Index can be helpful in establishing the diagnosis

surgeries, aspirin or NSAID sensitivity, and atopic dermatitis. Workup should include a complete blood count with differential to look for eosinophilia, total IgE, and allergy testing (by skin prick or blood IgE testing). Elevated IgE levels and *Aspergillus* sensitivity should prompt further workup for allergic bronchopulmonary aspergillosis (ABPA), which can be treated with antifungal antibiotics and high-dose steroids.

Allergic rhinitis can be managed with environmental avoidance measures and therapies, such as intranasal steroids, intranasal and systemic antihistamines, antileukotrienes, sinus rinses, and allergen immunotherapy. Chronic rhinosinusitis with nasal polyposis can be managed with these modalities, as well as biologics (dupilumab, omalizumab, and mepolizumab, described below). In addition, it is important to co-manage these patients with otolaryngology for surgical evaluation, management, and post-operative monitoring. In assessing any patient with a history of asthma and nasal polyposis, it is also helpful to determine a patient's response to aspirin and other nonsteroidal antiinflammatory drugs. Exacerbations of rhinitis or asthma following use of these medications indicate the possibility of aspirin-exacerbated respiratory disease (AERD). AERD can be treated with aspirin desensitization. In addition, emerging evidence supports the use of dupilumab in AERD [13–16]; we have found it helpful in our practice as well.

Atopic dermatitis, if uncontrolled, can play a role in asthma. Atopic dermatitis can be managed with counseling on appropriate skin care, avoidance of irritating products and fragrances, application of topical steroids when appropriate, and when severe, treatment with a biologic (dupilumab; see below). Attention to comorbid aeroallergen exposure, namely, dust mite sensitivity, can also improve atopic dermatitis outcomes.

It is also important to screen for non-atopic comorbidities. One common comorbidity which can both masquerade as asthma and also worsen existing asthma is gastroesophageal reflux. A history of reflux in uncontrolled asthma should prompt a trial of acid suppression therapy. Obesity is also closely related to poor asthma outcomes. Physicians should address obesity and provide basic diet and lifestyle counseling to these patients. Screening and treating for vitamin D deficiency has also been shown to benefit asthmatic patients. Finally, obstructive sleep apnea can also worsen asthma outcomes [4••]. It is important to evaluate sleep quality and screen for evidence of obstructive sleep apnea on history. This includes the presence of snoring, headaches, and daytime sleepiness. If a screen is positive, definitive diagnosis can be made with an overnight polysomnogram.

Biologics

Biologics play a crucial role in severe, uncontrolled asthma patients who cannot be optimized on the aforementioned therapies. In addition, biologics can target other comorbid atopic conditions which, if untreated, can exacerbate asthma, including nasal polyposis and atopic dermatitis.

In the USA, omalizumab was approved in 2003 for severe asthma in adults and children over 12 years of age, and in 2016 for children 6 years

old and up. Since then, four additional biologics have been approved in the USA for the treatment of severe uncontrolled asthma: mepolizumab in 2015, reslizumab in 2016, benralizumab in 2017, and dupliumab in 2018.

Traditionally, omalizumab was only administered in the office setting. However, during the COVID-19 pandemic, providers were encouraged to consider the risk–benefit analysis for each individual patient's specific case, and consider converting to home injections when appropriate, especially if the patient never had anaphylaxis, had tolerated their first three doses without problems, and demonstrated good health literacy [17, 18]. Since then, in our practice, the administration of biologic medications made a significant shift from the in-office setting to the home setting. With proper education, epinephrine auto-injector prescriptions, and an "anaphylaxis action plan," many of our patients have found that home injectable medications are safe and can be easily performed at home. In addition, this change has anecdotally increased a sense of empowerment and disease ownership for asthma patients.

The ability to do home injections for biologics also allows patients to treat comorbid atopic conditions, some of which can exacerbate asthma. In addition to asthma, omalizumab was also approved for chronic urticaria in 2014 and chronic rhinosinusitis with nasal polyposis in 2020. Mepolizumab, an IL-5 inhibiting agent first approved for asthma in 2015, received approval for eosinophilic granulomatosis with polyangiitis (EGPA) in 2017, hypereosinophilic syndrome (HES) in 2020, and chronic rhinosinusitis with nasal polyposis in 2021. Dupilumab, initially indicated for atopic dermatitis in 2017 (prior to its approval for asthma), was also approved for chronic rhinosinusitis with nasal polyposis in 2019. With proper counseling, the shift toward self-administration has been a positive change for patients who suffer multiple atopic comorbidities requiring biologics to achieve optimal control.

Subcutaneous immunotherapy and sublingual immunotherapy

Allergen immunotherapy, both subcutaneous immunotherapy (SCIT) and sublingual immunotherapy (SLIT), has been used to treat allergic asthma, in addition to allergic rhinitis and atopic dermatitis [19, 20]. Both SCIT and SLIT have the potential to cause systemic reactions or anaphylaxis [21, 22]. The American Academy of Allergy, Asthma, and Immunology (AAAAI) suggests that SCIT be done in the office with monitoring, while patients who tolerate their first dose of SLIT in the office can continue the remainder of their therapy at home, with an epinephrine auto-injector available [20]. The COVID-19 pandemic posed a challenge with respect to in-office monitoring. We considered shifting to SLIT; however, data suggests that SLIT may not be as effective as SCIT in the treatment of asthma [19]. Furthermore, since uncontrolled asthma is a risk factor for serious systemic reactions to immunotherapy, it can be delicate to balance the desire to treat asthma with allergen immunotherapy with the need to avoid risk in uncontrolled asthmatics.

Vaccinations

Since respiratory infections are an inciting factor for severe asthma exacerbations, it is crucial that asthma patients not only follow social distancing guidelines, but also be up-to-date on preventative vaccines such as pneumonia, pertussis, *Haemophilus* influenza, flu, and COVID-19 vaccines [4••, 23, 24]. Education on the benefits and impact of vaccines that can prevent severe lung infection plays an essential role. Furthermore, household contacts of severe asthmatic patients should also be counseled on the benefits of vaccines. In addition, physicians should consider that patients who are corticosteroid-dependent may also have suppressed immunity and dampened responses to vaccines.

Special considerations in children during the COVID-19 pandemic

The proper diagnosis and management of asthma in children is often challenging, even in ideal settings. Unlike adults, children, especially toddlers, are unable to verbalize the detail and frequency of their symptoms, and history is often limited to caregiver observations. Furthermore, young children are often unable to reliably perform in-office spirometry or cardiopulmonary exercise testing, thus reducing an objective assessment of asthma. Asthma in early childhood may present in a variety of ways, including wheezing and chronic cough. Viral-induced wheeze is a hallmark of early childhood asthma. The Asthma Predictive Index (API) is a scoring tool that physicians can use to predict the development of asthma in children who have a history of wheezing prior to 3 years of age. This simple scoring tool considers atopic dermatitis and a parental history of asthma as major criteria, and eosinophilia, wheezing apart from colds, and allergic rhinitis as minor criteria. The scoring system has low sensitivity but relative high specificity and a high negative predictive value for the diagnosis of asthma [25]. Clinicians should be familiar with this important tool as it can be readily applied during telemedicine visits.

Our patients generally exhibited improved control throughout the pandemic, with fewer emergency care visits and hospitalizations for asthma-related illness. This was likely related to the effects of a lockdown. For young children, the pandemic reduced exposure to peers with potential viral illness [26•]. In older children, cancellation of school, sports, and other activities decreased exercise and sleep deprivation, which are common triggers of asthma flares. While these patterns may be interpreted as an overall improvement in asthma control, physicians should exercise caution when stepping down therapy, especially if objective parameters such as pulmonary function, oxygen, and peak expiratory flow cannot be serially assessed following modification [27, 28]. The

Global Initiative for Asthma recommends continuing prescribed asthma medications [4••]. Others have advocated that modifications could be considered based upon underlying atopic status and baseline risk [26•]. We recognize that over-treatment of asthma with high-dose corticosteroids can lead to adverse outcomes. Our practice has been to encourage frequent telemedicine visits, with slow medication tapers in appropriate patients. If possible, we also encourage in-office visits for high-risk pediatric patients, such as those with a history of poorly controlled asthma, medication non-adherence, or the aforementioned comorbidities.

Conclusion

Since the onset of COVID-19, we found that many of our previously non-compliant asthma patients made more effort to schedule telemedicine visits, possibly driven by the fear of COVID-19 in asthma. As mentioned above, due to the shift toward remote clinical care, patients have been playing a larger role in their own asthma management. Examples include allowing them to keep oral corticosteroids "on-hand," instructing home administration of biologic medications, and providing benchmarks for patients to decide when an in-office visit is necessary. Although this level of responsibility seemed daunting at first, the overall impact on asthma control has been positive. Perhaps ironically, it seems that the COVID-19 pandemic improved the therapeutic alliance between physician and patient, as we observed a subsequent improvement in control, compliance, and emergency room utilization.

It is the hope that moving forward, even as we loosen restrictions on social distancing, the lessons we learned during the COVID-19 pandemic in asthma care remain intact. Perhaps much of what was initially thought to require constant in-person management can be achieved in alternative ways through effective patient education, improved health literacy, and patient empowerment.

Compliance with Ethical Standards

Conflict of Interest
Connie H. Lin declares that she has no conflict of interest.
Daniel A. Cerrone declares that he has no conflict 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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•• Of major importance

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