Chapter 12

ALLERGIC AIRWAY DISEASE AND DEPLOYMENT TO THE MIDDLE EAST

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INTRODUCTION

Globally, allergic respiratory disorders are a growing disease burden. In 2012, the National Center for Health Statistics (Atlanta, GA) reported that, in adults aged 18 years and older, 13% had been told they had asthma, with 8% reporting they still had asthma. Seven percent of this population had been told within the prior 12 months that they had hay fever, and 4% self-reported being told that they had chronic bronchitis.[1]

A key immune mechanism in allergic diseases is the sensitization of immunoglobulin E (IgE) antibody to triggers in the environment that are not normally considered infectious pathogens, such as pollens, animal dander, food protein, or *Hymenoptera* venom. The allergic respiratory disorders included in this chapter are limited to those whose primary clinical effect is limited to the nasal and bronchial mucosa: allergic rhinitis and asthma. The presence of IgE responses to airborne environmental triggers, or aeroallergens, can be identified by means of testing methods that look for allergen-specific IgE, both in vitro and in vivo. However, a thorough symptom history is often sufficient to raise clinical suspicion for the diagnosis, and initial management often occurs at the primary care level.

ALLERGIC AIRWAY DISEASES

Allergic rhinitis is one of the most common chronic diseases in the United States and is associated with allergen exposure that causes inflammation and an immune-mediated response, leading to symptoms such as sneezing, nasal itching, rhinorrhea, and nasal congestion.[2] Rhinitis due to non–IgE-mediated responses is also common and can be present alone or as a co-morbid condition in those with allergic rhinitis. Nonallergic rhinitis is characterized by nasal symptoms that are not due to allergen-specific IgE, and testing will not show clinically significant results. Common nonallergic rhinitis diagnoses include infectious, vasomotor, drug-induced, ingestion, hormonal, and nonallergic rhinitis with eosinophilia syndrome.[2]

Asthma can also have triggers that are mediated by specific IgE; however, the spectrum of triggers leading to an asthma exacerbation is broader in nature and comprises an evolving area of research. The increasing prevalence of asthma suggests an environmental component in the development of disease, but there are also genetic patterns of asthma seen in individual patients and in families. Such patterns suggest a gene–environment interaction, further suggesting that a genetically susceptible individual, when exposed to certain environmental conditions, is likely to develop asthma.[3]

The airway of an asthmatic is hyperresponsive to triggers, demonstrating reversible and variable airflow limitations—which are also key features of asthma—and the disease can show a waxing and waning pattern of variability.[3] This variability can present a challenge in diagnosing asthma in the young adult population from which the US military recruits, particularly when there is a childhood history of a reactive airway or wheezing that also includes extended asymptomatic periods. In general, the highest rate of asthma diagnosis is made during early childhood, and new-onset asthma is not commonly diagnosed in young adults.[3] However, there is evidence in the medical literature that subjects with a diagnosis of childhood asthma can have intermittent wheezing into adulthood.[4] The risk of respiratory symptoms in young adults creates a challenge for military service due to the limitations it may place on duty performance. A retrospective review of the British Army showed that recurrence of asthma in those with previously diagnosed childhood disease was most common between the ages of 17 to 21 years.[5]

MILITARY RELEVANCE OF ALLERGIC AIRWAY DISEASE

The US military is not immune to the health problems facing the US population. Accession standards for entrance to military service are intended to protect both the potential service member, as well as the military organization. Although medical management of diagnoses such as asthma and allergic rhinitis continues to improve, and these medical conditions are not limiting in many situations faced by young adults, military service demonstrates a unique situation. Physical fitness and the ability to work in a variety of global environments and unpredictable circumstances are mandatory conditions for service members of all military occupational specialties. The military environment requires the ability to wear protective masks and gear; to live and work in a broad range of austere climate conditions and elevations; and to endure exposure to sandstorms, vehicle fumes, or smoke from nearby explosive devices or burn pits. Medical providers evaluating potential military candidates or conducting medical screenings prior to a military deployment must consider these unpredictable factors as part of their decision-making process.

Army Regulation 40-501, *Standards of Medical Fitness,*[6] details the standards regarding both accession and retention for military service. Asthma, to include a diagnosis of reactive airway disease or asthmatic bronchitis, reliably diagnosed and symptomatic after the thirteenth birthday, is considered disqualifying for entrance to military service.[6] Applicants with disqualifying medical conditions can be granted waivers for entrance to military service. A review of medical waivers considered between 1997 and 2002 showed that asthma was one of the most common conditions for which waivers were requested and granted.[7] Of the more than 3,000 applicants initially disqualified from entering military service every year because of chest or lung problems, approximately 1,500 receive waivers for a history of asthma, and 750 of those eventually enter the military. The impact of allowing these applicants with a history of asthma to enter military service may not become evident during their training and time spent in a garrison environment, but the significance of asthma increases as the environment becomes more austere.[8]

Retention standards for service members diagnosed with new-onset asthma after entering military service are determined based on the ability to perform duty, and the diagnosis does not trigger an automatic discharge. Increased bronchial responsiveness and reversible airflow obstruction must be demonstrated for asthma to be diagnosed, and a soldier with chronic asthma may still meet retention standards if the clinical condition does not prevent the soldier from otherwise performing all military training and duties.[6]

CONSIDERATIONS FOR SERVICE MEMBERS WITH ALLERGIC RHINITIS AND ASTHMA BEFORE AND DURING DEPLOYMENT

Medical Screening

Service members eligible to deploy are expected to be in good health, particularly compared with the general population. Because of the limited availability of healthcare services for chronic medical conditions in an austere environment, healthcare professionals perform medical screenings to identify chronic conditions, determine whether any such conditions are currently stable, and identify the potential impact of deployment on that stability. In some cases, an individual must receive clearance from a subspecialty provider to deploy. Due to unique circumstances and the variations in medical echelons of care in a theater of operations, medical providers familiar with military regulations, occupations, and current theater conditions should serve as the clearance authority. The US military has board-certified subspecialists in allergy/immunology, pulmonology, and otolaryngology, some of whom have deployed and provided lessons learned on the impact that deployment conditions can have on underlying allergic airway disease.

Respiratory symptoms are common in a deployed environment, even in those personnel without underlying pulmonary conditions. However, adequate baseline control in service members with a diagnosis of asthma is key because those who deploy with poor control are at increased risk of developing worsening symptoms. In a survey of service members returning from Iraq and Afghanistan, cough and allergy symptoms were the most common respiratory complaints in both asthmatic and nonasthmatic individuals. Respiratory complaints were more prevalent in those asthmatic patients with poor baseline control of symptoms.[9] These poorly controlled patients also required more frequent visits to healthcare providers and were more likely to require hospitalization or evacuation from theater.[9]

Aeroallergens and Other Exposures During Deployment

Aeroallergens are derived from a variety of sources in the environment, including pollens (tree, grass, or weed), fungal/mold spores, animal dander, and insect feces. Individuals who demonstrate sensitization to aeroallergens are commonly poly-sensitized, which can make exposure control a difficult task.[3] Additionally, seasonal and geographical variations can impact military populations who have a global presence.

Seasonal and perennial allergens observed in the United States are also found in the Middle East. Seasonal patterns of pollination are similar as well, with tree pollen peaking in the spring, grasses in the late spring and summer (except for coastal regions where year-round grass pollen is found), and weeds in the fall.[10]

A pollen study conducted in Baghdad, Iraq, concluded that most of the pollen collected was from plants that are genetically related to plants of the southeastern part of the United States and known to trigger allergic rhinitis and allergic asthma.[11]

In Kuwait, the most prevalent species of molds found in the air were similar to those in the United States to which patients may be sensitized. The predominant mold species detected was *Aspergillus*,[12] a clinically relevant species for allergic asthma patients sensitized to this mold. Based on clinical and serological testing for *Aspergillus* sensitization, patients with *Aspergillus*-sensitive asthma and allergic bronchopulmonary aspergillosis had a significantly more severe asthma, indicating the importance of this exposure and potential sensitization in atopic individuals.[13] Other mold species identified in Kuwait include *Cladosporium* and *Alternaria*, both of which have also been identified with worsening respiratory symptoms in those asthma patients sensitized to these spores.[12,14]

Individuals with and without asthma or allergic rhinitis can suffer similar symptoms from airborne irritants or airway infections, such as those commonly found during deployment in the Middle East. Fine particulate dust, sandstorms, vehicle fumes, and smoke from burn pits or exploded ordinances are all potential airway irritants, especially in those individuals with underlying asthma. During a 5-year population-based study in Kuwait, 569 days (33.6%) had dust storm events, and they were significantly associated with an increased risk of same-day asthma and respiratory admission to the hospital.[15] Sandstorms are common in Iraq and Afghanistan and have been associated with an increased risk of hospital admission for both asthma and heart disease.[16]

The underlying etiology of worsening airway symptoms following sandstorms may not be solely from irritant-induced airway inflammation. In 2011, bacterial studies were conducted on the fine topsoil particles and airborne dust particles from 19 locations in Iraq and Kuwait. The results indicated the presence of potential human pathogens, including *Mycobacterium*, *Brucella*, *Coxiella burnetii*, *Clostridium perfringens*, and *Bacillus*. *C burnetii*, the causative agent of Q fever, was confirmed and detected in additional samples by use of polymerase chain reaction, indicating a high prevalence of this organism in the analyzed samples.[17] *C burnetii* has been associated with the exacerbation of asthma in adults and should be considered on the differential for infectious agents in deployed service members with nonspecific febrile illness in conjunction with other systemic symptoms, including pneumonia.[18]

The collective impact of minerals, metals, mold, pollen, pollutants, and climate change on the exacerbation of allergic disease in the local population suggests that healthcare providers should counsel deploying soldiers with allergic rhinitis regarding relevant allergen trends, ensuring that these individuals have appropriate medications.[10]

Medications

Availability and durability of medications while deployed should be considered during the predeployment medical evaluation screenings conducted on service members and certain civilians who will be working for the Department of Defense. Attention should be focused on the expiration dates of medications, the length of deployment, and the temperature conditions that may impact medications. According to several package inserts, the upper limit of daily temperature exposure for inhalers and topical nasal steroids is between 77°F and 86°F, which is difficult to ensure for self-carried medications given the desert temperatures.[19–21]

The first-line medications for patients with either allergic rhinitis or well-controlled asthma include short-acting beta-agonists, nonsedating antihistamines, and nasal corticosteroids.[2,22] Leukotriene inhibitors are effective as prophylactic medication for exercise-induced asthma and can be an additional agent used for allergic rhinitis; however, their use for mild persistent asthma is not preferred.[22,23]

Service members who are on a daily, inhaled corticosteroid at the time of their predeployment screening should receive additional medical screening to include a pulmonary function test that assesses how well controlled they are at baseline. These individuals, according to Army Regulation 40-501 (*Standards of Medical Fitness*), should already have received a P-2 medical profile (that notes the presence of minimally significant organic defects or systemic diseases) due to the requirement for a daily controller.[6]

Allergy immunotherapy (AIT), in general, cannot be supported in an austere environment, including deployment to a relatively well-established base such as Kandahar Airfield (Afghanistan). Specific challenges include temperature restrictions during transportation (extracts should be stored at 48°C to reduce the rate of potency loss) to the final facility, and the inability to account for medical training on AIT administration, including AIT-specific issues such as recognition and management of side effects (eg, anaphylaxis), as well as documentation and dose adjustment for those with local injection site reactions.[24]

Service members who are being considered for treatment with immunomodulators (eg, Omalizumab) are likely to be ineligible to deploy. Their condition may even prove too severe to permit their retention on active duty.

POSTDEPLOYMENT CONSIDERATIONS

All service members returning from deployment to Iraq or Afghanistan are required to have at least one healthcare encounter near their time of return to complete postdeployment health assessment processing, and another visit 3 to 6 months later to complete postdeployment health reassessment processing. These mandatory encounters present opportunities for healthcare providers to identify those individuals who may have symptoms that either began or worsened during deployment and have not waned since.

The Millennium Cohort Study collected health information on a variety of topics (eg, respiratory health, smoking status, demographic information, and deployment history). Respiratory questions included self-reported asthma, emphysema, chronic bronchitis, and persistent cough. Data analyzed from the Millennium Cohort Study concluded that there was no increased prevalence of clinically significant

pulmonary abnormalities 10 years after deployment.[25] However, this does not preclude the possibility that an individual with a specific exposure history or genetic predisposition could not develop a chronic respiratory condition during his/her time deployed. Clinical symptoms that are indicators that asthma is the likely diagnosis include historic symptoms, as well as those noted during current clinical presentation:

- cough, particularly worse at night;
- recurrent wheeze or difficulty breathing;
- recurrent shortness of breath;
- symptoms that worsen during exercise;
- viral infections;
- inhalant allergen exposure (animals, mold, pollen, and dust mite); and
- irritants (tobacco smoke, wood smoke, and airborne chemicals).

These symptoms should raise clinical suspicion for new-onset asthma in a patient who did not have previous symptoms.[22]

The differential for chronic respiratory complaints not responding to standard asthma therapy should include the following:

- cardiac issues;
- gastrointestinal reflux;
- pharmacological agents (eg, angiotensin-converting enzyme inhibitors);
- vocal cord dysfunction;
- chronic obstructive pulmonary disease;
- allergic bronchopulmonary aspergillosis;
- pulmonary infiltration with eosinophilia; and
- chronic infections (eg, tuberculosis).[22]

In addition to current clinical symptoms, a thorough history for redeployed service members with respiratory symptoms includes documenting detailed airborne exposure history. Although recall bias is an understood limitation, documentation of exposures while deployed may provide information for treating providers. A study that examined the pre- and postdeployment rates of inpatient and outpatient medical encounters for service members deployed to Iraq and Afghanistan found that the overall number of encounters decreased after deployment. However, there was a statistically significant increase in the encounter rates for obstructive respiratory diseases, primarily asthma or bronchitis, from the pre- to postdeployment periods for one-time deployers.[26] This study was limited by the lack of specific deployment-related exposures. Yet, in another study by Smith et al,[25] new-onset respiratory symptoms and cumulative exposure time suggest that specific exposures, rather than deployment in general, are better determinants of postdeployment respiratory conditions.

SUMMARY

Clearly, deployment to austere environments, in addition to the addressed physical requirements (eg, gear, protective masks, and unpredictable stressors), can have an adverse impact on service members. In particular, airborne irritants, allergens, and viral infections can further impact the health and capabilities of those warfighters who have an underlying predisposition to allergic airway conditions. The potential acute health effects of exposure to airborne pollutants on those with preexisting medical conditions (eg, asthma) are better studied in the near term.[27] However, efforts such as the Millennium Cohort Study demonstrate the forethought of researchers to identify long-term impacts on the respiratory health of US service members.

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