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Occupational Asthma

Review of Assessment, Treatment, and Compensation

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Occupational asthma refers to asthma induced by exposure in the working environment to airborne dusts, vapors, or fumes, with or without preexisting asthma. Potential triggers of occupational asthma are diverse and involve a variety of postulated mechanisms. After confirming the presence of asthma, diagnosis hinges on obtaining a detailed and accurate occupational and environmental history and documenting a temporal association of symptoms or signs with workplace exposure. Management of occupational asthma centers on prescribing standard asthma therapies in conjunction with instituting preventive strategies, such as appropriate avoidance of environmental triggers, providing work restrictions, and using environmental controls and/or personal respiratory protection. If a worker is determined to be ill or injured, there are a variety of compensation systems that are designed to protect workers financially from disability related to respiratory impairments; however, the administrative process is frequently difficult to navigate for patients and their providers. Focusing on obtaining a detailed occupational and environmental history, establishing clear objective data to substantiate illness, and estimating or apportioning workplace contribution to the condition is important for the diagnosis and treatment of this relatively common form of asthma.

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Abbreviations: LTD = long-term disability; MSDS = Material Safety Data Sheets; RADS = reactive airways dysfunction syndrome; SSDI = Social Security Disability Insurance; STD = short-term disability; WC = workers compensation

Asthma is not only a common respiratory condition that may initially present or recur in adulthood but also has been reported in many countries to be the most prevalent respiratory illness documented to be associated with occupational exposure. In the United States alone, it has been estimated that 15% of new asthma diagnoses are related to workplace exposures,¹ and hundreds of compounds have been shown to cause or exacerbate airflow limitation.

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DEFINITION AND CLASSIFICATION

Although a variety of classification schemes have been introduced to describe asthma in the workplace and streamline efforts to study the disease, it is important to understand that the evaluation and treatment of affected individuals, for the most part, remains the same. Occupational asthma has been defined as asthma induced by exposure in the working environment to airborne dusts, vapors, or fumes, with or without preexisting asthma.^{2,3} It includes the terms “sensitizer-induced asthma” and “acute irritant-induced asthma,” the latter coined “reactive airways dysfunction syndrome” (RADS), which refers to a type of occupational asthma for which there is no latency and no immunologic sensitization. The terminology is reserved for when a single high-dose irritant exposure has occurred.⁴ The term “work-related asthma” can be used to include occupational asthma, RADS, or an aggravation of preexisting asthma (also known as “work-aggravated” or “work exacerbated” asthma). Other diagnoses are occasionally confused with occupational asthma or may

coexist with it. One example includes “sick building syndrome,” which has been described in certain individuals who work in buildings with alleged variation in temperature, humidity, or lighting that have been associated with development of upper respiratory irritation, rhinitis, and occasionally nonspecific symptoms involving the skin and nervous system.⁵ Individuals who manifest upper airway symptoms from chemical odors like perfumes or cleaning agents are relatively common⁶ and do not necessarily have asthma⁷; they may represent a variety of illnesses somewhat poorly defined and include an overactive perception of irritants (referred to as sensory hyperreactivity⁸), but not necessarily a significant airway response to methacholine challenge testing.^{6,9,10} Vocal cord dysfunction (irritable larynx syndrome)¹¹ and eosinophilic bronchitis¹² are clinical syndromes that may be associated with patients presenting after workplace exposures with wheezing, dyspnea, or cough, but are not considered occupational asthma.

ETIOLOGY AND PATHOGENESIS

Inhaled agents in a workplace environment may lead to asthma by sensitization, by creating airway inflammation, or by irritant reflex pathways. Most data regarding occupational asthma have come as a result of studies focused on a specific industry or manufacturing process. For example, as many as 11% of spray painters exposed to diisocyanate-based paints have bronchial hyperreactivity,¹³ and roughly 5% of workers in the lumber industry exposed to western red cedar dust developed asthma.¹⁴ As many as 2.5% of all workers exposed to natural rubber latex¹⁵ and up to 20% of bakers or warehouse workers exposed to flour¹⁶ have been reported to have occupational asthma; farmers, painters, and cleaners have been reported to have the greatest risk for developing occupational asthma.¹⁷

Most forms of work-related asthma are associated with a period of latency from hours to months in duration. Since there are literally hundreds of inhaled agents that have been reported to cause occupational asthma, it has been useful to classify sensitizer-induced occupational asthma into high-molecular-weight and low-molecular-weight compounds. High-molecular-weight substances (>5,000 Da) include organic compounds, such as certain cereals, seafood, natural rubber latex, enzymes, and animal-derived allergens, as well as synthetic products, such as adhesives and certain gums used in the printing industry.¹⁸ Production of IgE antibodies and development of reversible airflow obstruction have been reported in susceptible individuals exposed to these products. Low-molecular-weight agents (<5,000 Da), such as acid anhydrides and platinum salts, seem to trigger asthmatic symp-

toms by acting as a hapten in conjunction with immunologic proteins to induce specific IgE antibodies. Several mechanisms have been suggested for other low-molecular-weight compounds, such as isocyanates in which IgE antibodies are seen infrequently and may involve a delayed-type hypersensitivity reaction, direct T-lymphocyte mediation, or other yet-to-be-defined pathways.

DIAGNOSIS

Work-related asthma should become part of the differential diagnosis of every case of adult-onset asthma or declining expiratory air flows in an individual with preexisting but previously clinically quiescent asthma. Most cases of occupation-related asthma are identified when the patient presents with asthmatic symptoms that they associate temporally with workplace exposures. However, it is of paramount importance that the clinician first establish the presence of reversible airflow obstruction (ie, confirm that asthma actually is the diagnosis) before labeling the individual with occupational asthma. Conversely, a detailed environmental and occupational history will often reveal a possible occupational association with respiratory symptoms in situations where exposure to certain (and frequently uncommon) irritants may not have been considered initially. The health-care provider must combine a detailed history with a thorough physical examination and high-quality pulmonary function testing, similar to the diagnosis of asthma in an individual with a non-work-related cause of asthma.

Symptom Patterns

The constellation of respiratory complaints encountered by individuals with a work-associated asthma, including cough, wheezing, chest tightness, and exertional dyspnea, is identical to that seen in patients with asthma without an occupational trigger. Certain individuals with work-associated asthma experience upper respiratory symptoms, such as rhinitis and conjunctivitis, prior to developing lower respiratory tract symptoms more commonly associated with nonoccupational cases. The clinician should specifically address the possibility of a relationship between symptoms experienced in the workplace, when the symptoms occurred, and if there was improvement in symptoms when the individual was away from work, particularly for extended periods of time, such as a vacation or employment furlough. Sensitizer-induced occupational asthma is more commonly associated with waxing and waning symptoms that follow a pattern of severity after exposure to specific antigenic triggers. Early responses involve symptom development within

just minutes of exposure to the inciting compound, frequently reach peak severity within 30 min, and resolve spontaneously within 1 to 2 h after removal from the exposure. Late responses refer to symptoms that develop approximately 4 to 6 h after the initial exposure, reach maximum severity by 8 h, and resolve within 24 to 36 h. Dual responses describe an early response followed by a return to baseline airflows and symptoms followed by a late response. Continuous responses involve patients who have no recovery time between the early and late responses. The type of response is difficult to document accurately in clinical practice and cannot, unfortunately, be used to determine the precise exposure trigger. However, based on studies done using specific challenge testing in a controlled environment, most IgE-mediated antigens are associated with early and dual responses, and antigens without an antibody-induced response seem to produce both dual and late responses.¹⁷

Work History

A detailed work history that includes all types of prior occupations, military service, part-time positions, and the specific duties performed in each workplace is time-consuming but vital to the accurate assessment of work-associated respiratory disease. Questions about coworkers with similar complaints and whether a sentinel event (eg, chemical spill, fire, or explosion) occurred at the place of employment may uncover clues to better assess the patient. Common questions that may tease out subtleties in an individual's exposure history are outlined in Table 1. Many of these questions lack specificity, but in approximately 70% of workers with respiratory symptoms that are alleviated over a weekend and 90% of patients who take vacation leaves of at least 7 to 10 days or are restricted temporarily from work for that time frame are later confirmed to have an occupational exposure leading to their illness.^{13,18,19}

When specific compounds are identified as possible agents causing respiratory illness, the health-care provider may request Material Safety Data Sheets (MSDS) to be supplied by the employer. These documents, which are to be kept accessible to the employee by the employer under federal law, describe the composition of compounds used in the specific work environment.²⁰ In recent years, MSDS information is available online, making it much more readily accessible to the clinician. However, it is important that health-care providers understand the significant limitation of this data source. For example, other than containing the physical properties of specific substances and listing certain health-related risks, the MSDS summaries are often incomplete because of manufacturers claiming proprietary information of

Table 1—Summary of the Approach to Evaluating Possible Work-Related Asthma

1. Does the clinical history suggest asthma?
2. What preexisting factors are there?
 - Tobacco abuse
 - History of childhood asthmatic symptoms or respiratory disease present prior to current workplace exposure
 - Upper respiratory tract infections or rhinitis
 - Symptoms associated with domestic pets, seasonal exacerbation of symptoms with pollen and dust exposures
 - Family history of congenital respiratory disease or atopy
 - Exposure from a hobby, second job, or home business
 - Medications that could cause cough or exacerbate asthmatic symptoms (eg, NSAIDs, ACE inhibitors, β -blockers, aspirin)
 - Concurrent symptoms of gastroesophageal reflux disease
3. Is there a potential occupational or environmental agent causing or exacerbating symptoms?
 - Temporal associations between work site and symptoms
 - Use of personal protective devices such as respirators
 - Improvement in symptoms when away from the potential exposure
 - Confirmation of the workplace exposure to a known sensitizer or respiratory irritant
 - Coworkers experiencing symptoms
4. What confirmatory tests should be performed?
 - Nonspecific airway hyperreactivity
 - Reversibility of airflow obstruction
 - Serial peak flow measurements both at and away from work
 - Skin patch testing
 - Specific IgE serum testing (RAST)
 - Specific antigenic challenge

ACE = angiotensin-converting enzyme; NSAIDs = nonsteroidal antiinflammatory drugs; RAST = radioallergen sorbent test. (Modified with permission from Rabatin and Cowl.²⁰)

key components of products, may be misinterpreted by the worker when used to assess potential exposure risks, and include often cursory or nonspecific information. In addition, the MSDS do not account for breakdown products of most compounds and interaction of multiple products, which may actually be more antigenic or harmful than the initial products themselves. Simply asking for MSDS data for every product to which an individual might be exposed in a workplace is unwieldy and often is ineffective for identifying specific antigens responsible for possible work-associated asthma. A certain amount of forensic sleuthing may be required. That is, the clinician must also corroborate that the products included in the MSDS provided by the employee are the compounds actually being used in the workplace by the patient, and if MSDS are provided by the employer, that the products included in the MSDS are current and fully inclusive.

Inquiring about the use of controls for protecting workers is also important when considering an individual with possible occupational asthma. Certain engineering controls, such as substitution of potentially dangerous products and local exhaust ventilation, may be very effective in protecting most workers,

but clarification of these controls often involves communication with the employer's representative to determine if the controls are being used daily, if the protective equipment is working properly, and if there have been recent changes in processes or redesign of facilities that may have affected the controls indirectly. It is also useful to inquire about use of personal protection in the workplace, such as gloves, hats, eye protection, ear protection, and respirators. If a respirator mask or a breathing apparatus is used, the specific details regarding the reliability and fit of the equipment should be obtained.

Confirmation Evaluation

The use of confirmatory testing to assess work-related asthma should hinge on appropriate pretest probability derived from the detailed medical and occupational history, the physical examination, and measurement of expiratory airflows.²¹ With each confirmatory test that reflects a positive response, the greater is the likelihood that the individual is experiencing respiratory illness caused or significantly exacerbated by a workplace exposure.²²

Details of obtaining high-quality pulmonary function testing, including the use of methacholine and histamine inhalation challenge testing, in the diagnosis of occupational asthma has been described previously.²³ The latest American College of Chest Physicians Consensus Statement on the diagnosis and management of work-related asthma suggested that for individuals with suspected sensitizer-induced occupational asthma, a methacholine challenge test or comparable measure of nonspecific airway hyperresponsiveness during a period of work exposure should be performed; the test should be repeated at least 2 weeks after the individual is removed from the suspected workplace exposure.³ Peak expiratory airflow measurements may also be useful in documenting temporal associations with workplace exposure and clinical exacerbations.²⁴

Use of specific serum immunologic testing,²⁵ skin prick tests,²⁶ and specific inhalation challenge testing²⁷ may be useful in diagnosing sensitizer-induced cases. Work-aggravated asthma may be caused by irritant airway exposures, but may not necessarily have positive nonspecific inhalation challenge testing results despite being consistent with asthma clinically.²⁸ Noninvasive measures of airway inflammation using induced sputum cell counts,²⁹ exhaled breath nitric oxide,^{30,31} and exhaled breath condensate³² have been analyzed; however, routine use of these modalities requires further study, and they have had limited use in the evaluation of work-related asthma because of issues with precision and lack of specificity.

Once a diagnosis of work-related asthma has been established, the management decisions are often complex, time-consuming, and involve significant administrative consequences for the patient due to the forensic nature of attempting to establish a causal association between exposure and disease. This is especially true when a variety of confounding factors exist, such as a worker who smokes tobacco, has hobbies or secondary positions that involve exposure to respiratory irritants, or demonstrates secondary gain behaviors. Although restriction from exposure to the presumed inhaled trigger may be advisable, the result may prevent the worker from returning to his or her previous work position when alternative employment is unavailable or the individual does not possess skills to provide the option to change careers.

Pharmacologic Management

Pharmacologic therapy is similar to that used for other forms of asthma. It hinges on a sequential approach to therapy as outlined in the Global Initiative for Asthma guidelines.³³ The only exception may be that in workers with irritant-induced asthma, providers may need to avoid use of powdered inhalant agents for delivery of inhaled corticosteroids and bronchodilators as the agents themselves may result in increased airway irritation and worsen symptoms of dyspnea, cough, and/or dysphonia within the first several weeks after exposure.

Workplace Restrictions

Although complete removal from the exposure in question may be ideal and could result in improvement in symptoms and expiratory airflow measurements for certain types of exposures (eg, documented airway sensitization),³⁴ the process of initiating and managing work restrictions requires a knowledge of the administrative process and forward thinking that will afford the highest probability that the worker can remain employed and do so safely in the future. The American College of Occupational and Environmental Medicine recently released a position statement outlining the importance of adopting a "disability-prevention model" focused on identifying ways for individuals to return to work safely in some capacity as soon as possible after a diagnosis has been ascertained.³⁵ The report emphasized the need to minimize the amount of time away from work due to nonmedical factors, such as administrative delays resulting from subspecialty referrals, lack of transitional work, ineffective communications, and logistic issues. In most cases, a strategy of identifying ways to avoid the alleged exposure while at work through

substitution of the product or moving the individual to an alternative work area, minimizing activities in which the potential asthmatic trigger is present, and/or modifying the method of work maneuvers that minimize exposures will allow the employee to return to work in some capacity. Prolonged time away from the workplace was viewed as harmful because work absence could lead to loss of social relationships at work, self-respect that comes with serving in gainful employment, and a major identity component of what the worker does for a living. Increased rates of anxiety and depressed mood are not uncommon if the patient remains off work.³⁶

Removal from irritant exposures may be required for workers with RADS for a period of time, but in many cases those same individuals may return to the work environment if exposure to irritant substances can be minimized. For instance, if a chemical spill results in a short but concentrated exposure, the affected individual may, after a period of recovery, be able to return to his or her prior position if the compound involved is then used properly and the probability of spill recurrence is low. Although reducing, rather than eliminating, the exposure for certain types of compounds may result in clinical improvements for individuals with work-related asthma and allow continued employment, this is not effective for certain compounds associated with sensitization of the airway (eg, isocyanate-based compounds); removal from the environment is typically the only option in these cases. Interestingly, some workers may actually refuse work restrictions and continue to serve in an unrestricted capacity if concerns about financial loss outweigh the perceived benefit of avoiding the workplace exposure altogether. This may result in gradual worsening of symptoms and poorer long-term outcomes as well as worsening airflow measurements, and in rare cases even death.³⁷

There are several caveats unique to the evaluation and treatment of work-related asthma that separate it from other occupational injuries or illnesses. These differences have been articulated in a guideline report released by the American Thoracic Society in 1993, and include the fact that work-related asthma involves significant variation in clinical status, that airflow limitation may be completely reversible with correct management, that the condition is associated with upper respiratory irritants (eg, smoke, dust, and chemical fumes) often found solely in the workplace environment, and that repeated occupational exposure may account for progressive airway inflammation that leads to chronic and irreversible disease.³⁸ It is incumbent upon the health-care provider to communicate to the patient the importance of eliminating potential disease cofactors, such as smoking, and to communicate diplomatically with the employer

regarding the use of education for employees about handling of high-risk materials and conducting medical surveillance in the workplace to identify other potential cases of work-related asthma.

ADMINISTRATIVE ISSUES REGARDING PROVIDER REIMBURSEMENT AND COMPENSATION TO THE WORKER

In the specific case of work-related asthma, a definitive diagnosis based on objective data should be made prior to documenting that an individual's respiratory condition is associated with their occupation. Coding and billing with associated issues regarding reimbursement for the care of occupational asthma is often enigmatic—not necessarily because of the nature of the illness or treatment strategies but because of the complexity and variability of existing compensation programs, terminology, and laws such as short-term disability (STD), workers compensation (WC), long-term disability (LTD), Social Security Disability Insurance (SSDI), and the Family Medical Leave Act.

Impairment vs Disability

The World Health Organization defines impairment as “any loss or abnormality of psychological, physiological, or anatomical structure or function.” Conversely, disability means activity limitation that creates a difficulty in the performance, accomplishment, or completion of an activity in the manner or within the range considered normal for a human being.³⁹ The latter is an administrative determination, made after consideration of the severity of impairment and the nature of the physical or mental requirements of an occupation in which the individual has participated or is being considered. For example, an individual with paraplegia clearly has impairment with respect to loss of function of the lower extremities; however, that individual may not necessarily be disabled from their ability to have gainful employment in a sedentary or clerical role.

STD Insurance

STD insurance provides a proportion of an employee's income if that person becomes impaired and consequently disabled, whether the condition was work related or not. Most STD policies compensate at 50% to 75% of an individual's predisability pay for a period of up to 3 to 6 months, and the majority of policies include a maximum amount of benefits paid each month.⁴⁰ Depending on the policy, the individual may have to use paid time off from work (eg, vacation or sick days) prior to receiving STD benefits. Many STD policies have restrictions on

when benefits accrue. For example, an injury from a fall would be paid immediately, whereas benefits for an illness such as occupational asthma may require a waiting period to assess whether the severity of the illness is such that the employee cannot return to work in any capacity for an extended period of time. Frequently, STD policies provide income retroactively if the illness is proven to be substantial or severe.

LTD Insurance

If an individual is unable to return to work in any capacity for an extended period of time, LTD insurance is often provided by the employer using pretax dollars to provide benefits after STD claims have been exhausted (therefore, employee benefits are taxable). LTD policies may also be purchased by the individual employee using after-tax dollars to pay premiums (payments are then tax-free). There are a wide variety of insurance policies available to employers and individuals, and benefits paid do not hinge on the illness or injury being work related. Some policies have definitions that involve coverage of an individual's "own occupation" for up to a specified time period (eg, 24 months), at which point benefits are paid only if the individual is unable to work in any capacity or is unable to work in a position that provides a certain proportion of his or her prior salary. These policies are often tightly case managed and involve requirements for the employee to receive regular care and provide documents substantiating continued disability.⁴⁰

Workers Compensation

WC is a type of no-fault insurance policy mandated by law for most businesses in all 50 United States that provides compensation for medical care and usually some form of wage replacement for employees who are injured or who become ill in the course of employment, in exchange for mandatory relinquishment of the employee's right to sue his or her employer under negligence tort. Each WC system is unique to each state, as well as for several federal jurisdictions. An illness or injury, in order to be accepted as a work-related claim, must be established as caused by or exacerbated by a workplace activity. When a worker is injured or encounters a work-related illness, the individual may be eligible for additional benefits because of a partial or total permanent impairment. Each WC system involves a prescribed reimbursement based on a permanent impairment rating of the whole person given in a percent. There are several impairment rating guides published, but many states defer to a publication produced by the American Medical Association.⁴¹ Most services rendered by health-care providers are reimbursed at a set fee for the specific WC system for which the injury or illness

occurred. For example, if a patient works in the state of Iowa and is evaluated in Minnesota, that individual would be covered under WC in Iowa and reimbursement would come from a specific schedule approved by WC statutes governing that state. Record review and correspondence, often a time-consuming and onerous activity, may be considered for reimbursement within some WC systems (CPT code 99199 or "Unlisted special service, procedure or report"); in fact, certain states allow for providers to bill for each 50 pages of records reviewed in the course of performing a comprehensive occupationally related examination. Services rendered are billed under customary evaluation and management codes. Coding strategies for assessment and treatment of asthma using methacholine challenge testing⁴² as well as measurements of oximetry⁴³ have been addressed previously in articles published within the "Topics of Practice Management" series of this publication.

Independent Medical Evaluation

Although determination of the percentage of impairment was initially intended to be hinged on strict objective data to arrive at a final degree of injury, there remains significant subjectivity in determination of opinions between providers. For many cases, an independent medical evaluation is required. This involves a forensic evaluation in which a health-care provider is asked to make a determination regarding the diagnosis and effects of the illness or injury without forming a doctor-patient relationship, and, in theory, independent of the plaintiff (ie, the claimant or employee) or defendant (ie, the insurer or employer) in the case. The examiner, based on records provided, a current physical examination, and within reasonable medical certainty, determines if the individual did indeed suffer an illness or injury, and if so, what the diagnosis is or was. The provider will assess if the patient has reached maximal medical improvement and, if so, whether the individual may return to work with or without restrictions. If limitations in certain activities or exposures are necessary, the examiner will often provide workplace restrictions. Finally, for evaluations with a specific work-related cause (and if requested and appropriate to the specific case), the examiner will make a determination of partial or total permanent impairment rating for WC purposes based on the statute or guidelines mandated by the governmental agency or policy overseeing that particular WC system. Although there are no published requirements for the format of these forensic reports, there are organizations that exist to provide specialized training in performing independent medical evaluations as well as a specific educational certificate available for interested providers.

SSDI is a federal payroll tax-funded insurance program administered by the Social Security Administration, developed to provide lost wage benefits to individuals who have been determined to have a severe medical condition that renders them unable to work in any form of gainful employment over a period of 12 months or more. The injury or illness does not necessarily need to be work related. Workers frequently must undergo an evaluation by a health-care provider designated by the Social Security Administration (by a formal chart review or a physical examination) and benefits are adjudicated through an administrative law judge. This form of LTD insurance is frequently used to offset LTD benefits paid from private insurers, and patients are typically required to apply for SSDI benefits under the stipulations of most LTD plans.

CONCLUSION

Work-related asthma is a common form of respiratory disease involving the airways. The precision and accuracy of diagnosing the condition is improved by taking a detailed exposure history and using a sequential approach for obtaining the objective data required to substantiate the presence of reversible airflow obstruction and to associate illness with environmental exposure. Treatment often is focused on avoidance of the inciting trigger and, as a result, many patients may be unable to perform their previous workplace activities. If an individual is identified as having work-associated asthma, there are compensation systems in place to protect the worker; however, these systems are often complex to navigate. From the provider's perspective, clear documentation in the medical record with reliable objective data to confirm a work-related illness frequently helps to guide work restrictions and to later assess impairment should that become necessary.

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