Occupational airways disease

Joanna Szram

Abstract

Airway disease can be either caused or made worse by occupational exposures; early recognition of work-related disease is crucial to achieving a successful outcome for the patient. It has been estimated from population research that 10–15% of adult asthma presentations (either new cases or exacerbations of existing disease) can be attributed to a work exposure. Work-exacerbated and occupational asthma have different causal pathways and therefore require different management by healthcare professionals as well as employers. Obtaining a full, precise job history and carefully applying simple but powerful diagnostic investigations are key in successfully distinguishing between the two conditions. Appropriate management can result in cure, although in most cases there is a significant socioeconomic cost to the patient. Toxic exposures to workplace respiratory irritants can also result in airways disease; symptoms are generally short lived and self-limiting but can occasionally result in an asthma-like syndrome ('irritant-induced asthma'). Several specific occupational exposures have been causally associated with chronic obstructive airways disease; diagnosis can be complicated because of the long latency between exposure and clinically evident disease, and can be confounding by smoking. Other rare, occupationally induced airway diseases such as obliterative bronchiolitis require specialist consideration.

Keywords Asthma; COPD; obliterative bronchiolitis; occupation; work

Key points

- Occupational asthma (OA) — a new disease induced by an exposure at work — is common
- In patients presenting with work-related symptoms, it is important to distinguish OA from work-exacerbated asthma, which includes current or past (even childhood) asthma
- It is important to consider the evidence for OA carefully and if in doubt consult clinicians with specific experience in the field; false-positive diagnoses can be disastrous
- Apart from a small number of well-described work exposures, the attribution of chronic obstructive pulmonary disease to occupation is challenging. Detecting patients with an accelerated decline in lung function through high-quality workplace spirometry is a widespread practice among occupational health teams managing employees with significant residual risks (those remaining after appropriate exposure controls are in place) to lung health
- A number of airways diseases can result from irritant exposures in the workplace; these require precise characterization

Introduction

Asthma is the most frequently reported occupational airways disease. Chronic obstructive pulmonary disease (COPD) can also be associated with certain occupations. Toxic airway damage and obliterative bronchiolitis can occur following irritant exposures in the workplace.

Asthma and work: definitions

Adults with pre-existing asthma commonly encounter difficulties with their disease at work, especially when their asthma is inadequately controlled. There is potential in the workplace for exposure to a large variety of respiratory irritants, such as chemicals (ammonia, solvents, industrial perfumes) and general 'nuisance' dusts, as well as environmental factors such as cold or dry air (common in food-related industries). Physical and early-morning work can also prove problematic. Pre-existing disease worsened by workplace exposure is referred to as 'work-exacerbated' asthma (WEA). Management consists of a combination of control of irritant exposures at work and optimization of pharmacological treatment.

In contrast, 'true' occupational asthma (OA) is defined as disease starting *de novo* and caused by an exposure at work. Distinguishing between WEA and OA is important because identifying an occupational aetiology provides a real (and rare) chance to cure a patient of their asthma. WEA and OA together make up the 10–15% of cases of adult asthma that are described as work-related asthma.

Occupational asthma arising from sensitization

Most cases of OA arise through sensitization to an airborne workplace allergen. Less commonly, asthma develops following a high-dose exposure to a respiratory irritant; this has been referred to as reactive airways dysfunction syndrome (RADS) (Table 1), although the term 'irritant-induced asthma' is now more common.

Pathophysiology

New occupational asthmagens continue to be reported; comprehensive lists are provided in print[1] or online. The several hundred known asthmagens are categorized by their molecular mass.

Joanna Szram *PhD FRCP is a Consultant Respiratory Physician specializing in Occupational Lung Disease and Director of Medical Education at the Royal Brompton and Harefield NHS Foundation Trust, London, UK and Honorary Senior Lecturer, Department of Population, Occupational Medicine and Respiratory Epidemiology, National Heart and Lung Institute (NHLI), Imperial College, London, UK. Her research interests include diagnostic approaches to occupational rhinitis and asthma, the impact of asthma on safety-critical and military roles and the role of workplace respiratory surveillance in disease prevention. Competing interests: none declared.*

Criteria for a diagnosis of reactive airways dysfunction syndrome

- Onset after a single toxic exposure to gas, smoke, fume or vapour with irritant qualities that was present in very high concentrations
- Onset within 24 hours of the exposure and persistence for at least 3 weeks
- Symptoms consistent with asthma (cough, wheezing, dyspnoea)
- Evidence of subsequent airflow obstruction (may or may not be evident)
- Evidence of subsequent non-specific bronchial hyperreactivity (methacholine or histamine challenge test)
- Documented absence of prior respiratory symptoms
- Other pulmonary disease excluded
- Non-smoker

Table 1

High-molecular-mass (HMM) agents are usually proteins and act as complete allergens, producing an immune response characterized by cytokine release from T helper type 2 cells and resulting in the induction of specific immunoglobulin E (IgE) antibodies.

Low-molecular-mass (LMM, defined as <2 kDa) substances generate a more complex immunological response but are presumed to become allergenic only after they have conjugated with a host protein. Only a few, such as acid anhydrides and complex platinum salts, have been shown to result in measurable specific IgE production. The mechanism of disease is unclear in other cases proven to induce a specific asthmatic response in exposed individuals when tested using an inhalational challenge. Fortunately for the general clinician, only a few agents are responsible for most disease — these are listed in Table 2.

History

OA is an immunological process and the clinical presentation mirrors this, with a latent (asymptomatic) period, typically lasting several months from first exposure, during which sensitization occurs. This exposure onset is generally at the beginning of a new job, but can result from changes in job role or process. As with other hypersensitivity-mediated disease, symptoms can be provoked by decreasing exposures to the initiating agent.

Patients with OA typically present with a history of respiratory symptoms that began within 2 years of new employment, initially improving away from work (this reversibility decreases over time) and increasingly easily provoked by being at work. In some patients, initial presentation is characterized by multiple 'chest infections'.

This typical history can be complicated by:

- symptoms felt only after, rather than at, work because of an isolated late-phase response; this manifests as symptoms developing after work or waking the individual from sleep
- progressive disease in which improvement away from work takes longer to develop
- changing hours of work, such as shift work or overtime
- pre-existing asthma or recurrence of childhood disease; distinguishing these from a new, occupationally caused disease is crucial to patient management and requires considerable care and expertise
- varying exposures within a job, dependent on the current work role

High-risk occupations and relevant exposures for the development of occupational asthma

High-molecular-mass agents		Low-molecular-mass agents	
Occupation(s)	**Agent(s)**	**Occupation**	**Agent**
Baking, milling, pastry- and pizza-making	Flour(s), α-amylase, other enzymes	Electronic solderers	Colophony fume
Detergent enzyme manufacturers	Detergent protease, amylase, lipase, cellulase	Hairdressers, manufacturers of circuit boards	Persulphates
Flower and vegetable farmers	Pollens, horticultural nematode pesticides	Healthcare workers	Glutaraldehyde, methyl/butyl methacrylate
Healthcare workers	Latex, enzymatic endoscope cleaning agents	Metal refiners and electroplaters	Complex platinum salts, chrome
Laboratory animal researchers and technicians	Rat, mouse, guinea pig, hamster and other animal proteins	Pharmaceutical manufacturers, healthcare workers	Penicillins, morphine, cimetidine, other drugs
Laboratory animal researchers (embryology), bakers, confectioners, food processors	Egg proteins	Plastics and foam manufacturers and assemblers	Acid anhydrides, epoxy resins
Other food processors	Garlic, enzymes	Spray painters, French polishers, plastics and foam manufacturers	Diisocyanates
Seafood processors	Prawn, crab, other (shell)fish proteins	Textile workers	Reactive dyes
Tea packers, coffee processors	Herbal teas, green coffee beans	Woodworkers, lumberjacks	Red cedar, iroko, other tropical sawdusts

Table 2