Occupational & Environmental Lung Disease: What the Generalist Needs to Know

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PRESENTATION IN 3 PARTS:

1. MAJOR RESPIRATORY ENTITIES TO CONSIDER
2. TARGETED OCCUPATIONAL HISTORY-TAKING
3. ILLUSTRATIVE CASES

HOW IMPORTANT IS OCCUPATIONAL ILLNESS IN OVERALL WORK-RELATED DISEASE?

10 Leading Types of Work Disease: NIOSH (1983)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Disease</th>
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<tbody>
<tr>
<td>Lung</td>
<td>Reproductive</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>Psychological</td>
</tr>
<tr>
<td>Cancer</td>
<td>Hearing Loss</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Acute Trauma</td>
</tr>
<tr>
<td>Skin</td>
<td>Neurological</td>
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OCCUPATIONAL LUNG DISEASE

- Usual emphasis: Asbestosis, silicosis, coal workers’ pneumoconiosis
- Largely irrelevant to general practice...
IN CONTRAST TO PNEUMOCONIOSIS, OCCUPATIONAL ASTHMA IS RELEVANT

4 Types of Asthma to Consider:
1. Synthetic, low-molecular weight chemicals (e.g., urethane)
2. High-molecular weight, naturally occurring (e.g., animal dander)
3. Irritant-induced, de novo (e.g., chlorine gas)
4. Work-exacerbation of pre-existing asthma (e.g., low-dose irritant, physical environment)

THE KEY MECHANISTIC PRINCIPLE:

• Responses to sensitizers differ from non-specific irritants
  – If sensitized, even low levels → response
  – For irritant-induced asthma, higher (irritant-level) exposures → not specific response

FEBRILE INHALATIONAL SYNDROMES

• Metal fume fever:
  – Due to galvanized metal fume

• Organic dust toxic syndrome:
  – Heavy exposure to high levels of organic dust (shoveling moldy woody chips)
TOXIC PNEUMONITIS IS NOT FUME FEVER....

- Cadmium fume: flame-cutting previously soldered metal
- Mercury fume: can occur in the home refining of gold or home spills
- Chemical lung injury: waterproofing spray

✓ Severe illness with alveolar injury
✓ Caveat: This would warrant immediate referral for hospitalization

OCCUPATIONAL RESPIRATORY TRACT CANCER

- Major issue of concern
- Acute exposures often raise inappropriate fears
- Chronic exposure risk difficult to assess in single individual

Selected Carcinogens RR>2.0

<table>
<thead>
<tr>
<th>Substance</th>
<th>Cancer</th>
<th>Occupation</th>
</tr>
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<tbody>
<tr>
<td>Asbestos</td>
<td>Mesothelioma; Lung cancer</td>
<td>Construction, shipbuilding</td>
</tr>
<tr>
<td>Arsenic, Chromium</td>
<td>Lung Cancer</td>
<td>Metal working; smelter work</td>
</tr>
<tr>
<td>Specialty Chemicals</td>
<td>Lung Cancer (including small cell)</td>
<td>Chemical industry; chemist</td>
</tr>
</tbody>
</table>
Selected Carcinogens RR≥1.5

<table>
<thead>
<tr>
<th>Substance</th>
<th>Cancer</th>
<th>Source</th>
<th>Risk</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radon</td>
<td>Lung</td>
<td>Uranium mining and milling</td>
<td>OR 5.0 for 200 WLM cumulative</td>
<td>OSHA: 4 WLM per year (64 in 14 yrs)</td>
</tr>
<tr>
<td>Radon</td>
<td>Lung</td>
<td>Residence</td>
<td>1.50 per 11 WLM for 14 yrs = 4 pCi/L average</td>
<td>EPA: Fix your home if radon level ≥ 4 pCi/L</td>
</tr>
</tbody>
</table>

WLM = Working level month

“SICK BUILDING” SYNDROME

- Complaints typically non-specific
- Often ← inadequate air exchange
- Other factors: humidity, smells
- Caveat: Mainly respiratory symptoms → suspect alternative diagnosis: [e.g., hypersensitivity pneumonitis]

EMERGING DISEASES

- Popcorn worker’s lung / diacetyl (bronchiolitis obliterans)
- Work-related rhinitis (same agents that cause occupational asthma)
- Pneumonia from new infectious agents (SARS, H1N1 in health care and animal workers) and established zoonotic pathogens with new outbreaks (Q fever; leptospirosis)
Targeted Occupational and Environmental Respiratory History

- Doesn’t need to be encyclopedic
- Should be systematic
- Emphasize issues pertinent to case
- Include some general screening items

Categories of Questions

1. Job and job process
2. Exposure levels
3. General hygiene
4. Temporal trends
5. Respiratory protection
6. Specific exposures

Job and Job Process

- TELL ME WHAT YOU DO EXACTLY
  - [Job title?]

- Walk me through the job process
  - Describe equipment [How is it powered?]  
  - Is it an open system or closed system?
Job and Job Process

• Who does maintenance and when?
  – Where are you at those times?

• What other work stations are near by?

Exposure Levels

• Do you see dust in the air

• Is there a strong smell [does it go away?]

• Are surfaces dusty, damp, moldy, peeling, eroded?

• Do you blow dust out your nose/cough it up?
Exposure Levels

- Are there windows or any general ventilation?
- Any special ventilation? Ever checked?
- Was your workspace originally used for its current purpose?

General Hygiene

- How big is the workplace?
- Anyone else there ill?
- Do you have a uniform – who cleans it?
- Do you eat or smoke at the worksite?
Temporal Aspects

• **ANYTHING NEW AT THE JOB?**
  – Job process/job duties/work product
• Are symptoms any better or worse...
  – The first day after back after days off?
  – On evenings or nights after work?
  – By the end of the work week?
  – When on vacation? [Away or at home/]

Respiratory Protection

• Do you ever use a mask?
• What does it look like?
• Were you ever tested to see that it fit?
  – Facial hair allowed?
• How often is it changed or serviced?

Other Protection

• Do you ever use a gloves?
  – Latex (powdered?)
  – Does stuff come through?
• Wear special work clothes?
  – Apron?
• Other gear?
  – What?
Specific Exposures
*Examples: Respiratory*

- Ever around?
  - Asbestos [insulation, heat-resistant material]
  - Silica [sand, sand-blasting, rock-crushing]
  - Two-part glues, sealants, epoxy, urethane
  - Blasting or military exposures
  - Construction or shipyard work
  - Agricultural dusts

Checklists can be far more detailed [e.g., silica]: At this job at any time did you or any co-workers at the same site do any of the any of the following....

- sandblasting
  - concrete finishing
  - jack-hammering or drilling rock or concrete
  - casting or foundry work
  - polishing or grinding
  - metal or blade sharpening
  - earth-moving, tunneling, or blasting
  - demolition work
  - quarrying or mining
  - plowing or tilling

A Final Work Question...

- Did any job you haven’t mentioned have regular exposure to....

  *vapors, gas, dusts, or fumes*
Taking an Environmental History: Focused Approach

- Indoor Home Environment
- Surrounding Neighborhood
- Exposures Brought In to Home

Indoor Environment

I. Age and condition of dwelling
II. Fuel sources, ventilation, plumbing
III. Pets (in good health?)
IV. Second-hand cigarette smoke
V. Anything change recently?
Outdoors - Neighborhood

I. Nearby industry or agriculture
II. Air quality – pollution sources
III. Traffic proximity and density
IV. Anything change recently?

“Imported” Exposures

I. Home hobbies/avocations
II. Home use of industrial products
III. Relevant cultural practices
IV. Anything change recently?
Taking an Environmental History: Final Question

Anything else change recently at home or in the neighborhood that I should know about?

Clinical Case Presentation

Case One

- 25 year-old female
- Complains of chronic cough for 6 months
- Non-productive
- Exacerbated by secondhand smoke

Further History

- No wheeze or dyspnea
- No post-nasal drip or dyspepsia
- No previous lung disease
- Seasonal rhinitis; diet-controlled HTN

Exposure History

- Cough began following a cleaning event
- Was scouring tiles in the bathroom
- Used two different products in sequence
- One of the products was a household bleach
Irritant Exposure History

Salient Features

- Mixing bleach + other products
- Bleach + acid leads to chlorine gas
- Acids include citric (vinegar), phosphoric, HCl
- Bleach + ammonia leads to chloramine

Next Question To Ask

What would provide the most useful data on incident?
1. Obtain product labels or material safety data sheets
2. Delineate acute irritant symptoms that occurred at the time of the incident
3. Determine length of exposure time
4. Ask if respiratory protection used
Irritant Properties and Effects

**Anticipated Acute Symptoms**

- Water soluble irritant gases
- Acute onset of mucous membrane irritation
- Eye irritation, rhinorrhea, cough
- Lower lung injury (airway and alveolar) following severe exposure

Product Identification

**Relative Importance**

- Precise identification of materials is always useful
- More important if the clinical presentation is discordant with the history
- The key historical issue is immediate onset consistent with the presumed exposure
- Delayed onset (hours to days) or mainly non-respiratory symptoms would be unusual

Other Questions

**Relative Priorities**

- Length of exposure is usually brief
- This is not usually a chronic or repeated exposure scenario
- Respiratory protection is unlikely to be available in cleaning operations (either unsalaried at home or salaried)

Further Information

**Examination and Laboratory Testing**

- The physical examination is unrevealing
- Cough with forced expiration, but no wheeze
- Spirometry shows FEV\textsubscript{1}, FVC, PEFR WNL; FEF\textsubscript{25-75} is reduced
- Chest x-ray without abnormality
Quantifying Airway Responsiveness

Rationale for Early Assessment

- The normal or near normal PFTs do not exclude airway hyperresponsiveness
- If airway hyperresponsiveness is present, the presumptive diagnosis is established
- If absent, differential dx is markedly shifted
- Serial PEFR monitoring is an option as well if increased variability documented

Other Diagnosis Branch-Points

Imaging and Bronchoscopy

- Little in history to suggest conditions requiring lung CT (bronchiectasis, BO).
- Severe irritant sequelae (following hospitalization, intubation) could warrant it
- No post-nasal drip, but sinus evaluation might become important as co-factor
- Bronchoscopy premature given data, unless part of a research protocol

What is the Next Test That You Would Obtain?

Choose Best Answer

1. HRCT scan of the lungs + sinus CT
2. Total IgE, rast battery, eosinophil count; if positive refer for desensitization shots
3. Obtain a serial PEFR measures or perform a methacholine challenge
4. Refer to pulmonary specialist for potential bronchoscopy with BAL
Role of Atopic Disease

*IgE, RAST, Eosinophils*

- Atopy may indeed be a risk factor for prolonged symptoms after irritant exposure
- Need not be present, however
- If atopy confirmed (likely given seasonal rhinitis) it will not exclude or include the central diagnosis or impact the prognosis

Airway Hyper-responsiveness Test Was Positive

*Therefore, the most appropriate diagnosis is:*

1. Irritant-Induced Asthma (RADS)
2. Cough-Equivalent Asthma
3. Vocal Cord Dysfunction
4. Psychogenic Cough

Irritant-Induced Asthma

*Reactive Airways Dysfunction Syndrome (RADS)*

- High level, discrete irritant exposure event
- Acute onset of respiratory symptoms
- Continuation of symptoms for >3 months
- Non-specific airway hyperresponsiveness

Other Diagnoses

*Rationale for Rejection:*

- Cough-equivalent asthma is also correct, but “generic” diagnosis obscures the etiology
- Vocal cord dysfunction can be a co-morbid condition in some cases, but no data here
- Psychogenic cough is a diagnosis of exclusion
Clinical Management of Case

The Highest Priority Intervention Would Be:

1. Eliminate exposure to cleaning products
2. As needed β-agonist monotherapy
3. Anti-inflammatory inhaler ± β-agonist
4. Reduce secondhand smoke exposure

Management of RADS

Relative to Standard Asthma Management

- There are no data to suggest RADS should not be treated in a standard way
- The case suggests a level of symptoms for use of anti-inflammatory therapy
- Trial of β-agonist alone can be considered.
- Follow-up for response to therapy critical

Management of RADS

Relative to Standard Asthma Management

- Specific sensitization not involved
- No need to remove or avoid low level exposure
- Responses to non-specific irritant stimuli should be reduced with better control of hyperresponsiveness
- Still a good idea to reduce ETS exposure

How common is this?

What proportion of adult asthma is attributable to occupational factors?

1. 1-3%
2. 4-6%
3. <9%
4. One in ten or more
Key Points

- Recent data review indicate 10-15% of adult asthma is attributable to work factors
- This excludes "work aggravated" asthma
- This excludes asthma in non-salaried (e.g. household) work
- The occupational role in COPD seems to be of a similar magnitude (10-15%)

Clinical Case Presentation

**Case Two**

- 39 year-old male 2 days of fever and chills
- Temperature 38.4; no rash/localizing findings
- WBC 17.9 with shift LFT increase
- Develops cough, bloody sputum next day

Additional Clinical Information

- No risk factors for immuno-compromise
- No sick contacts
- + Smoker, no drugs, social alcohol only
- No travel
- On no medications
- Manager/maintenance for small apt building
**Focused Occupational and Environmental History**

One key question to ask?

1. Any heavy exposure to indoor molds?
2. Any notable or unusual exposure in the last week?
3. Any sick exotic pets in building?
4. Have you used pesticides, paints, or cleaning products recently?

![Bar chart showing percentages](chart.png)

**Infectious Disease**

Role of Occupational and Environmental Exposures

- Should be as routine as a travel history
- Acute exposure: has anything changed
- High risk jobs with ongoing exposure; health care providers, lab workers, animal exposure
- Certain vocations (camping, hunting, sports)

**Other Issues**

Exposures to Assess

- Despite public concerns, no link between indoor mold and severe “toxic” illness
- Chemical toxins can masquerade as infectious disease, but usually with more focal organ effect
- Exposure to exotic animals could be of interest, but is not highest priority

**Additional Exposure Data**

- Did makeshift plumbing job 5 days ago
- Exposure to raw sewage
- Work probably generated aerosol and skin contamination
- Only thoroughly washed-up at the end of the day
Differential Diagnosis

For clinical course and exposure which is most likely:

1. Hepatitis A
2. Hanta virus syndrome
3. SARS
4. Leptospirosis
5. Tularemia

Occupationally-Related Infection

Salaried Work and Hobbies/Vocations

- Leptospirosis – Sewage, contaminated water (outbreaks in triathlon competitors)
- Other traditional zoonoses
- SARS – Health care providers and lab workers
- Monkey pox – Animal handlers
- Hanta virus – Cleaning and custodial work
**KEY TAKE-HOME POINT:**

Unless we consider the possibility of work-related (and environmental) risks when treating patients in a general care setting, there is no hope of identifying such factors in the etiology of disease.