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Early detection of occupational diseases What can we learn from cases from the clinic?

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Early detection as part of the health surveillance





Overview

- 1. Early detection of silicosis
- 2. Early detection of occupational asthma
- 3. Detection of a new occupational disease

Re-emergence of silicosis in artificial stone workers

- Spain: > 250 cases
- Australia: >250 cases
 - Active screening with CT scan:
 98 cases / 799 screened workers
- Israel, Italy, US and Belgium



Don't wait until workers have symptoms

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Netter's Illustrated Human Pathology, 2014; Frankel, 2015; Hoy, 2018; Kirby, 2019; Ronsmans, 2019

Early detection of silicosis (and other silica-induced health effects)

- 1. What is the level of exposure?
- 2. Questions
 - Respiratory symptoms
- 3. Spirometry
 - Can be normal, obstructive, restrictive in workers with silicosis
 - Longitudinal interpretation
- 4. Imaging
 - Chest X-ray
 - Chest CT (high-risk workers)

Codex, Bijlage VI.1-4: Opsporingstechnieken; 3.1.1. Vrij kiezelzuur (o.a. kwarts). a) Radiografisch onderzoek van de borstkas b) Jaarlijks



Health surveillance in silica exposed workers

2020: Five cases from 1 company







NIOSH. Get Valid Spirometry Results Every Time. Publication No. 2011-135 Graham BL. Standardization of Spirometry 2019 Update. Am J Respir Crit Care Med. 2019 Oct 15;200(8):e70-e88.

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Interpretation spirometries

1. Quality

8



Interpretation spirometries

- 1. Quality
- 2. Compare with predicted values (general population)
- 3. Compare with own values (previous spirometries)
 - Excessive decline =



Redlich et al. Official American Thoracic Society technical standards: spirometry in the occupational setting. AJRCCM, 2014 Apr 15;189(8):983-93.

Interpretation spirometries

- 1. Quality
- 2. Compare with predicted values (general population)
- 3. Compare with own values (previous spirometries)
 - Excessive decline =
 - FEV_1 %pred ≥ 15% decline from baseline FEV_1 %pred
 - Rate of FEV₁ decline > 60–90 ml/yr (linear regression line)
 - Normal rate of FEV_1 decline (in healthy non-smokers) = 20–30 ml/year





SPIROMETRY

Spirometry Longitudinal Data Analysis (SPIROLA) Software

https://www.cdc.gov/niosh/topics/spirometry /spirola-software.html

https://www.cdc.gov/niosh/topics/spirometry /spirola-quick-calculation.html



ast observation:	
Rate of FEV1 decline:	Overall: 98 mL/year, 95% CI (49, 138)
	Last 8 years: 98 mL/year, 95% CI (44, 152)
Rate of FVC decline:	Overall: 93 mL/year, 95% CI (49, 138)
	Last 8 years: 93 mL/year, 95% CI (44, 152)
EV1 within-person variation:	235 mL; 4,9%; (normal <= 5%);
VC within-person variation:	196 mL; 3,5%; (normal <= 5%);
EV1 group within-person variation:	224 mL; 5,2%; (normal <= 5%);
VC group within-person variation:	307 mL; 6,1%; (normal <= 5%);

Interpretation and suggested actions:

• If a rate of FEV1 or FVC decline within the last 8 years >90 mL/yr is confirmed, results indicate excessive FEV1 or FVC decline.

Examine the spirometry quality and retest to confirm the results. If the results are confirmed, consider further evaluation, more frequent testing, and intervention.

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Case (Feb 2020)

- Man, 47 y, never-smoker
- Since Sept 2019
 - Runny nose
 - Dyspnea, wheezing
- Work: Printer since 1991
- Tasks: Setup and maintenance of the printing press
 - New printing press since August 2019
 - Anti-set-off powder is sprayed on printed paper
- Spirometry
 - FVC: 5.06 L (92%)
 - FEV₁: 4.10 L (94%)
 - FEV₁/FVC: 82%



What is occupational allergic asthma?

- 1. Asthma = variable airway obstruction
 - Symptoms
 - Variable dyspnoea + wheezing
 - Nonspecific bronchial hyperresponsiveness
 - Spirometry
 - Usually, normal!
 - Sometimes obstructive (FEV₁ \downarrow , FEV₁/FVC \downarrow)
 - Diagnosis @ general practice / pneumologist
 - Reversibility (FEV₁ +12%) after β_2 -agonist
 - Or: Histamine/methacholine provocation test +

2. Exposure to sensitizer at work

 Sometimes possible to prove sensitization: specific IgE or skin prick test

3. Time relation to work

- Latency period
- Often first rhinitis, later also asthma
- Symptoms improve during weekend or holiday



Duration of exposure

Early detection of occupational allergic asthma

- 1. Exposure to sensitizers at work?
- 2. Questions
 - Rhinitis symptoms?
 - Asthma symptoms?
 - When did symptoms start?
 - Latency period?
 - Do the symptoms get better during the weekend or holiday?
- 3. Skin prick test or specific IgE
- 4. Spirometry
 - Normal does not exclude occupational asthma
 - Longitudinal interpretation



Duration of exposure

Case

1.	Exposure	to	sensitizers	at	work?	
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2. Questions

- Rhinitis symptoms?
 - Runny nose
- Asthma symptoms?
 - Dyspnea, wheezing
- When did symptoms start?
 - Weeks after new printing press
- Do the symptoms get better during the weekend or holiday? Yes

8.	Skin prick test or specific IgE	Total IgE	306	kU/L	<= 114
L	Spirometry	Specific IgE			
		Maize (f8)	0.30	kU/L	< 0.10
	Normal does not exclude occupational astrima	Pea (f12)	9.48	kU/L	< 0.10
	 Longitudinal: not available 	Potato (f35)	1.01	kU/L	< 0.10

Anti-set-off powder	the product	processing line / workshop	the factory	
	"-" for absence, "+" for presence			
Maize and products thereof	-	+	ŧ	
Pea and products thereof	+	+	+	
Potato and products thereof	-	+	+	
Caffeine	-		-	

Presence in Presence in the Presence in



Sequential peak flow measurements





= working days

= daily average peak flow

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- Man, °1986, ex-smoker, unremarkable history
- 2013: diagnosis of sarcoidosis
- Since 2005, working in a production unit of 30 workers making J





"one of my workmates also has sarcoidosis"

Case B

- Man, °1981, ex-smoker, unremarkable history
- 2008: diagnosis of sarcoidosis
- Since 2005, working in the same production unit

Sarcoidosis

- Development of immune granulomas in various organs
- Caused by an interaction between:
 - Genetic susceptibility
 - Exposure to 1 or more environmental factors

Epidemiological studies

- Metals
 - Beryllium (chronic beryllium disease)
 - Other metals
 - Kucera et al. 2003: Metal workers: OR 7.47 [1.19 47.06]
 - Newman, 2004: Car industry: **OR 8.00** [1.07-354.98]
 - Liu, 2006: Job in metal sector: **OR 1.41** [1.08-1.85]
- Silica
- Vihlborg, 2017: 2187 workers in 10 iron foundries (1930 2013) Highest silica exposure (>0.048 mg/m³): OR 3.94 [1.07-10.08]
- Jonsson, 2019: Cohort: 297,917 construction workers Medium/high exposure: **RR 1.83** [1.14–2.95]
- Organic dust: moulds, birds, ...



lannuzzi et al; N Engl J Med 2007;357:2153-65. Moller et al; Ann Am Thorac Soc. 2017 Dec;14(Suppl 6):S429-S436 Sverrild, et al; Thorax 2008;63:894-896.



CHEST

Original Research

Izbicki et al, Chest 2007; 131:1414-1423

WORLD TRADE CENTER-RELATED PULMONARY DISEASE

World Trade Center "Sarcoid-Like" Granulomatous Pulmonary Disease in New York City Fire Department Rescue Workers*





Tubes heated + clipped

Dust = 'fused silica' Limit value: **0.3 mg/m³**

Personal dust sampling during cleaning of machine (1h): **6 mg/m³**



Case A

Mediastinal lymph node



Lung



Arguments suggesting relation work - disease

- 2 / 30 workers with "sarcoidosis" (normal prevalence 4.7-64 / 100 000)
- Exposure to glass dust > limit value
- Birefringent particles in relevant areas of lung or mediastinal lymph node
- Clinical improvement after removal from exposure

Received: 26 April 2019	Revised: 27 June 2019	Accepted: 3 July 2019		
DOI: 10.1002/ajim.23030				
CASE REPORT		AMERICA INDUSTRIA	N JOURNAL OF AL MEDICINE W	ILEY
Granulom bulbs	atous lung	disease in two workers making	light	
Steven Ronsma	ns MD ^{1,2}	Eric K Verbeken MD, PhD ³ Els Adams MD ¹	.,4	
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Take home

- The time relation between exposure and clinical presentation matters
- Ask questions
- Spirometry
 - A "normal" spirometry does not exclude occupational asthma, nor silicosis
 - Interpretation should be longitudinal
- Early detection: combine individual and group level perspectives