

Respirator Safety in Workers with COPD and Asthma

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Outline

- Basics of COPD, asthma
- Respirator Safety Issues
 - Exposure
 - Work of breathing
 - Questions to ask
- Tools
 - History/Physical
 - Imaging
 - Function
- Cases
- Summary

Definition

- Chronic obstructive pulmonary disease (COPD)
 - preventable and treatable disease state characterized by air flow limitation that is not fully reversible. The air flow limitation is usually progressive and is associated with an abnormal inflammatory response of the lungs to noxious particles or gases, primarily caused by cigarette smoking. Either chronic bronchitis or emphysema may be present.

Definition

- Asthma
 - common chronic disorder of the airways that is complex and characterized by variable and recurring symptoms, airway obstruction, bronchial hyperresponsiveness, and an underlying inflammation.

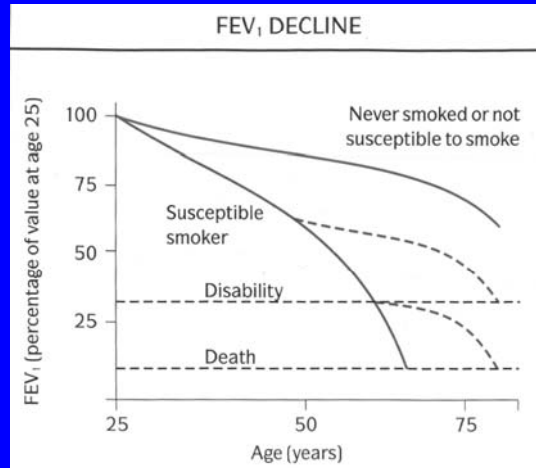
COPD

- Epidemiology
- Diagnosis
- Treatment

COPD: Impairment

- Criteria
 - FVC
 - FEV1
 - FEV1/FVC
 - DLCO
 - VO₂max

Effect of Smoking



Asthma

- Epidemiology
- Diagnosis
- Treatment

Asthma: Impairment

- Criteria
 - Post bronchodilator FEV1
 - Bronchial hyperreactivity
 - Minimum medications

Respirator Safety

- Protection from the environment
- Protection from the respirator

Respirators



Respirators: Positive Aspects

- Protection from respirable toxins
- Supply of controlled atmosphere

Respirators: Negative Aspects

- Discomfort
- Claustrophobia
- Decreased field of vision
- Allergy
- Increased work of breathing

Work of Breathing

- Energy expenditure required for breathing
- Factors
 - host condition
 - external conditions
- Difficult to quantify

Questions to Ask

- Is a respirator necessary?
- If so, what type of respirator is necessary?
- What is the employee's pulmonary condition?
 - diagnosis
 - level of impairment
 - co-existing morbidities
- What is the impact of the respirator?
 - work of breathing
 - other
- Can the employee use the respirator safely?

Tools

- History
- Physical examination
- Imaging
 - chest x-ray, CT, high resolution CT (HRCT)
- Labs
 - ABG, CBC, metabolic panel
- Pulmonary function tests
 - spirometry, lung volumes, DLCO, bronchial provocation, exercise testing

History

- Symptoms
- Exposure history
- Smoking history
- Review of symptoms

Respirator Questionnaire

- OSHA Standard 1910.134
- Appendix C
- Mandatory and optional sections

Respirator Questionnaire

Indiana University Purdue University Indianapolis/Indiana University School of Medicine

RESPIRATOR PROGRAM QUESTIONNAIRE

This questionnaire will be used to determine whether or not you have a medical condition that may affect your ability to wear a respirator. All medical information is considered confidential. Please answer these questions honestly.

Name: _____ SSN: _____

Sex of Birth: Male Female Age: _____ Height: _____

Department: _____ Job Title: _____

How best to reach you: _____ (Home or Cell) _____ (Home/Fax) _____ (Work/Fax)

1. Check the type of respirator you will use: _____ (Disposable Respirator Used for 15 MINUTES or less) _____ (Other Type) _____

2. Have you worn a respirator before? _____ YES _____ NO

3. Do you currently smoke tobacco, or have you ever smoked in the last month?

4. Have you ever had any of the following conditions?

5. Have you ever had any of the following problems or been prohibited?

6. Do you currently have any of the following symptoms of pulmonary or lung disease?

7. Have you ever had any of the following symptoms of pulmonary or lung disease?

8. Do you currently have any of the following symptoms of pulmonary or lung disease?

9. Have you ever had any of the following symptoms of pulmonary or lung disease?

10. Do you currently have any of the following symptoms of pulmonary or lung disease?

Name: _____ ID: _____

Please check appropriate box below:

| | NO | YES |
|---|----|-----|
| 1. Shortness of breath when working or breathing apparatus? | | |
| 2. Shortness of breath that interferes with your job? | | |
| 3. Coughing for more than 3 weeks (acute or chronic)? | | |
| 4. Coughing that occurs mostly when you are lying down? | | |
| 5. Wheezing? | | |
| 6. Wheezing that interferes with your job? | | |
| 7. Chest pain when you breathe deeply? | | |
| 8. Any other symptoms that you think may be related to lung problems? | | |
| 9. Have you ever had any of the following cardiovascular or brain problems? | | |
| 10. High blood pressure? | | |
| 11. Angina? | | |
| 12. Heart failure? | | |
| 13. Feeling tired, lightheaded or dizzy when working? | | |
| 14. Have you ever had any of the following respiratory or lung problems? | | |
| 15. High blood pressure? | | |
| 16. Have you ever had any of the following symptoms of heart symptoms? | | |
| 17. Chest pain or tightness in your chest? | | |
| 18. Have you ever had any of the following symptoms of heart symptoms? | | |
| 19. Have you ever had any of the following symptoms of heart symptoms? | | |
| 20. Have you ever had any of the following symptoms of heart symptoms? | | |
| 21. Have you ever had any of the following symptoms of heart symptoms? | | |
| 22. Have you ever had any of the following symptoms of heart symptoms? | | |
| 23. Have you ever had any of the following symptoms of heart symptoms? | | |
| 24. Have you ever had any of the following symptoms of heart symptoms? | | |
| 25. Have you ever had any of the following symptoms of heart symptoms? | | |
| 26. Have you ever had any of the following symptoms of heart symptoms? | | |
| 27. Have you ever had any of the following symptoms of heart symptoms? | | |
| 28. Have you ever had any of the following symptoms of heart symptoms? | | |
| 29. Have you ever had any of the following symptoms of heart symptoms? | | |
| 30. Have you ever had any of the following symptoms of heart symptoms? | | |

Use only for the health care professional who will review this questionnaire by calling:
 Occupational Health Services at 317-474-4214

Form I-100

Physical Examination

- General
- Vital signs
- Pulmonary
- Cardiac
- Extremities
- Skin

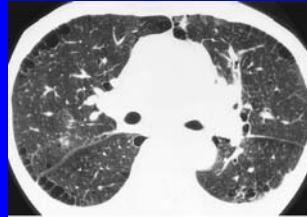
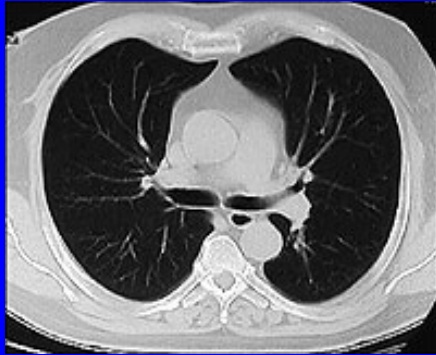
Imaging

- Chest x-ray
- CT
 - standard
 - high resolution (HR)

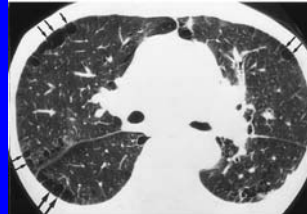
Chest X-Ray



CT Scan



A



B

Lab Tests

- ABG
- CBC
- Metabolic panel

Pulmonary Function Tests

- Peak flow
- Spirometry
- Lung volumes
- Diffusion capacity carbon monoxide (DLCO)
- Bronchial provocation


Equipment



Equipment



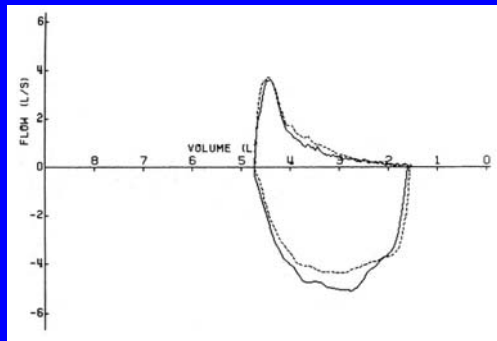
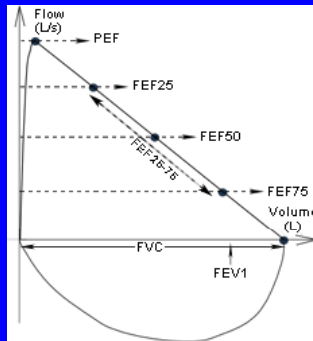
Pulmonary Function Test

 Carian Health
 IU PFT Lab: 317-274-7511

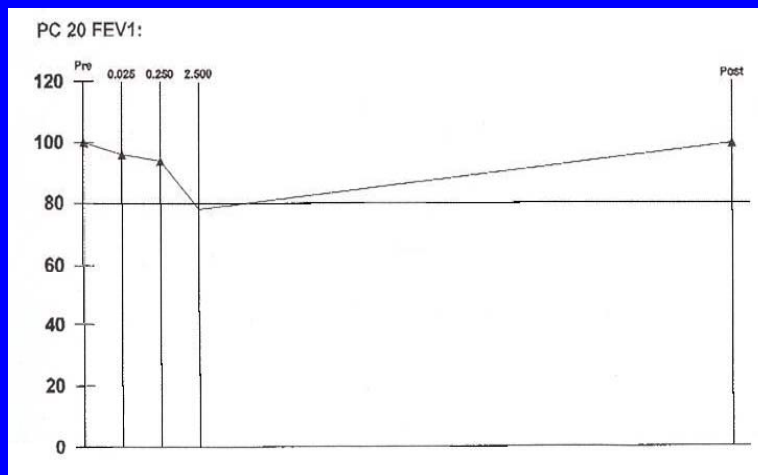
PFT Report
 PBar: 734 Temp: 22
 Version: IVS-0101-20-5B
 PF Reference: NHANES_III (Cauc) +LV +D

| | | Ref | (LLN-ULN) | Pre | % Ref | Post | % Ref | %Chg |
|---------------------------|---------------|-------|---------------|-------|-------|------|-------|------|
| Spirometry | | | | | | | | |
| FVC | Liters | 5.70 | (4.7 - 6.7) | 5.53 | 97 | | | |
| FEV1 | Liters | 4.39 | (3.5 - 5.3) | 1.45 | 33 | | | |
| FEV1/FVC | % | 77 | (87.6 - 87.0) | 26 | | | | |
| FEF25-75% | L/Sec | 3.76 | (2.0 - 5.5) | 0.37 | 10 | | | |
| FEF75-85% | L/Sec | | | 0.13 | | | | |
| PEF | L/Sec | 10.66 | (8.1 - 13.2) | 5.03 | 47 | | | |
| FET100% | Sec | | | 25.30 | | | | |
| FIF50% | L/Sec | | | 6.74 | | | | |
| Lung Volumes | | | | | | | | |
| TLC | Liters | 8.00 | | 7.66 | 96 | | | |
| VC | Liters | 5.70 | (4.7 - 6.7) | 5.53 | 97 | | | |
| IC | Liters | 3.95 | | 3.77 | 96 | | | |
| FRC N2 | Liters | 4.05 | (2.6 - 5.5) | 3.89 | 96 | | | |
| ERV | Liters | 1.75 | | 1.37 | 78 | | | |
| RV | Liters | 2.30 | (1.5 - 3.1) | 2.14 | 93 | | | |
| RV/TLC | % | 29 | | 28 | | | | |
| Diffusing Capacity | | | | | | | | |
| DLCO | mL/mmHg/min | 31.9 | (23.9 - 39.9) | 15.8 | 50 | | | |
| DL Adj | mL/mmHg/min | 31.9 | (23.9 - 39.9) | 15.8 | 50 | | | |
| DLCOVA | mL/mmHg/min/L | 3.99 | | 2.49 | 62 | | | |
| DLVA Adj | mL/mmHg/min/L | 3.99 | | 2.49 | 62 | | | |
| VA | Liters | 8.00 | | 6.35 | 79 | | | |
| IVC | Liters | 5.70 | (4.7 - 6.7) | 4.37 | 77 | | | |

Flow Volume Loop



Bronchoprovocation



Exercise Testing

- Types
 - 6 minute walk test
 - Cardiopulmonary exercise testing
- Cardiopulmonary exercise testing
 - Format
 - treadmill, stationary bicycle
 - Data
 - HR, BP, RR
 - EKG
 - PO_2 , PCO_2 , VO_2 , VCO_2 , V_D/V_T
 - Spirometry
 - Use

Exercise Testing

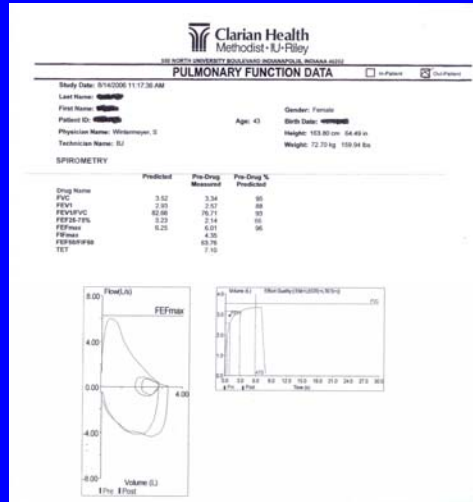


Cases

Case 1

- 43 yo African American female
- Hx: occupational asthma due to toluene diisocyanate (TDI) exposure
moved to different company 4 years ago
has done well
- Shortness of breath with running
- Meds: albuterol prn (uses 1x/week)

Spirometry



Work Environment

- TDI
 - Used in a specific area of the facility
 - Ventilation has not changed in last 4 years
- Production specialist
- Respirator
 - Half-face with organic cartridge

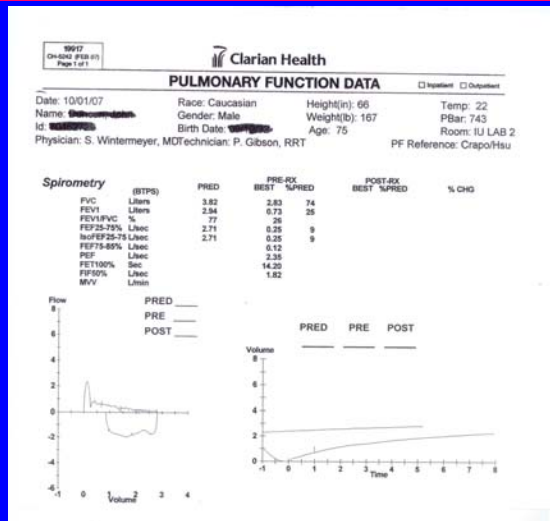
Questions

- Is a respirator necessary?
- If so, what type of respirator is necessary?
- What is the employee's pulmonary condition?
- What is the impact of the respirator?
- Can the employee use the respirator safely?

Case 2

- 75 yo Caucasian male
- Hx: diagnosed with emphysema 20 years ago.
Tobacco: 1 ppd (50 pack-years)
- Symptoms:
has to stop for breath when walking at own pace on level ground
shortness of breath when washing or dressing himself

Spirometry



Work Environment

- Safety officer
 - asked to come back from retirement
- Manufacturing facility
 - dirty
- 8 hour shift
 - 4 hours in office, 4 hours on floor

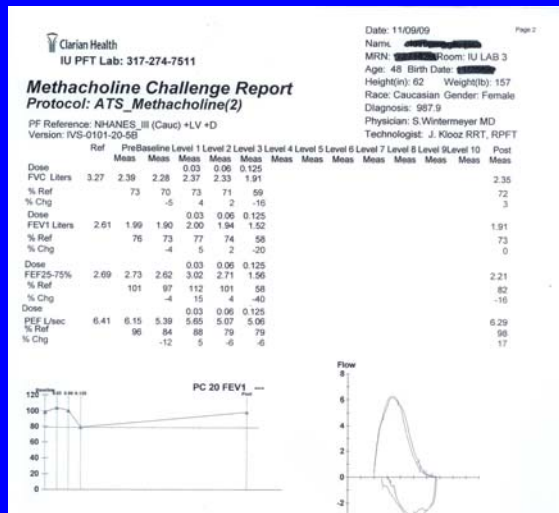
Questions

- Is a respirator necessary?
- If so, what type of respirator is necessary?
- What is the employee's pulmonary condition?
- What is the impact of the respirator?
- Can the employee use the respirator safely?

Case 3

- 48 yo Caucasian female
- Dx: Asthma for 10 years
Environmental allergies since childhood
- Symptoms: Shortness of breath that interferes with the job when picking up a load of certain chemicals
- Meds: albuterol prn (uses 2x/week)

Spirometry



Work Environment

- Truck driver
- Variety of loads
 - usually finished product
 - occasionally partially processed materials
 - occasionally raw materials

Questions

- Is a respirator necessary?
- If so, what type of respirator is necessary?
- What is the employee's pulmonary condition?
- What is the impact of the respirator?
- Can the employee use the respirator safely?

Summary

- COPD and Asthma
 - common
 - large variability in impairment
- Respirators
 - present hazards
 - increased work of breathing
- Useful tools
 - history
 - pulmonary function testing
- Key questions
 - What respirators are needed?
 - What respirators are safe?

References

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