Spirometry Workshop for Primary Care Nurse Practitioners

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Disclosures

No financial relationship with any pharmaceutical manufacturer or medical device company
Workshop Schedule

- 1:15 – 2:20 PM – Spirometry introduction
- 2:20 – 2:50 PM - Hands on spirometry & break
- 2:50 – 4:30 PM – Case Presentations

Objectives

- 1. Discuss the indications for performing spirometry.
- 2. Describe the correct manner for preparing both the spirometer and the patient for lung function testing.
- 3. Carry out spirometry procedures on self and other participants.
- 4. Assess the spirometry tracings with normal, obstructive & restrictive patterns.

Spirometry

- Gold standard for diagnosis of asthma & COPD
- Measure severity & progression of disease
- Measure treatment response
- Aid in diagnosis of restrictive & obstructive diseases
- Aid in smoking cessation with calculated lung age – current recommendations
Hazards of Spirometry

- Bronchospasm
- Cough
- Lightheadedness
- Syncope

Patient Preparation

- Comfortable, loose clothing
- Avoid heavy meal within 2 hours
- Avoid vigorous exercise within 30 minutes
- Use bathroom prior to testing
- No short-acting beta agonists for 4 hours
- Patient sitting

Prepare the Spirometer

- Calibration of the spirometer
- Disposable mouthpieces
Lung Volume Terminology

Spirometry Reference Values

- NHANES III values for ages 8 - 80
  - Caucasians
  - African-Americans
  - Mexican-Americans

Predicted Values

- Large population studies
- AGE
Ethnic Corrections

- Reductions:
  - African-Americans = 12 to 15%
  - South Indians = 13%
  - Japanese American = 11%
  - Polynesians = 10%
  - North Indians & Pakistanis = 10%

Predicted Normal Lung Volumes

- Based on large population surveys
- Predicted values are the mean values obtained from the survey

Lung Volume Measurements

* Forced Vital Capacity (FVC) = maximum volume of air exhaled from the lungs after a maximum inspiration.

* Forced Expiratory Volume in One Second (FEV1) = volume exhaled during the first second = this should be ≥ 80% of FVC
**FEF 25-75%**
- Forced Expiratory Flow = the flow that occurs between 25 to 75 % of the FVC
- Also called MMEF = maximum mid-expiratory flow
- Represent airflow in medium or small airways
- LEAST reliable & controversial
- Normal = > 35 % predicted

**Normal Lung Volume Values**
- FEV₁/FVC: Ratio > 70 %
  (> 80 % for children)
- FVC: > 80 % predicted
- FEV₁: > 80 % predicted

**Disease Patterns**

<table>
<thead>
<tr>
<th>Normal</th>
<th>Obstructed</th>
<th>Restricted</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV₁/FVC &gt; 70 %</td>
<td>Down</td>
<td>Normal</td>
<td>Down</td>
</tr>
<tr>
<td>FVC &gt; 80 % Pred</td>
<td>Normal</td>
<td>Down</td>
<td>Down</td>
</tr>
<tr>
<td>FEV₁ &gt; 80 % Pred</td>
<td>Down</td>
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Obstructive Changes

- Asthma
- Chronic Obstructive Pulmonary Disease
- Bronchiectasis
- Cystic fibrosis

Restrictive Changes

Pulmonary
- Idiopathic pulmonary fibrosis
- Any interstitial lung disease (over 200 types currently listed)
- Pneumonectomy/lobectomy
- Pulmonary edema
- Rheumatoid arthritis
- Sarcoidosis *
- Scleroderma

Extra-pulmonary
- Thoracic chest wall deformity
  - Pectus excavatum
  - Kyphoscoliosis
- Congestive heart failure
- Neuromuscular problems
- Obesity
- Pregnancy
- Poor effort
Spirometry Tracings

- Two basic types of display:
  1) Flow/volume loop
  2) Volume/time curve

Expiration is the area that can be found above the “waterline.” This is the most important part of the flow volume loop in lung diseases.

Flow/Volume Loop

Volume/Time Curve

Liters

FEV₁

Seconds

FVC

FVC
Volume-Time Curve

Normal versus Obstructive & Restrictive patterns: flow-volume loop

Vocal Cord Dysfunction

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Reversibility

- Reversibility can be assessed with albuterol and/or ipratropium (Atrovent) via MDI or nebulizer.

- Reversibility is defined by a change of at least 12% post bronchodilator AND an increase of 200 mL.

Seven Step Spirometry Interpretation

- Steps 1 and 2 – Quality Assurance
  1. Is the test at least 6 seconds long?
  2. Is the flow volume loop the correct shape?

- Steps 3-5 – establish the numbers
  3. Is the FEV1/FVC ratio more or less than 70%?
  4. Is the FVC more or less than 80% predicted?
  5. Is the FEV1 more or less than 80% predicted?

- Step 6 – identify the pattern
- Step 7 – classify severity

Quality Assurance

- Acceptability criteria (apply first)
  1. Min. 3 acceptable tests, max. 8 attempts
  2. Good start/rapid rise/no hesitation/no false start
  3. No cough, especially in 1st second
  4. No early termination: 6 secs or obvious plateau
Quality Assurance

- Reproducibility
  - Best two FVC's within 150 ml of each other
  - Best two FEV₁'s within 150 ml of each other
- Stop if repeated efforts trigger bronchospasm

Performance of Spirometry

- Instruct and demonstrate test to patient
  - Nose clips
  - Inhale completely
  - Position mouthpiece
  - Exhale with maximal force
- Position patient
- Coach!

Classification of Severity-COPD

<table>
<thead>
<tr>
<th>Stage</th>
<th>GOLD (2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I – Mild COPD</td>
<td>FEV₁ &gt; 80% predicted</td>
</tr>
<tr>
<td>II – Moderate COPD</td>
<td>FEV₁ 50 – 80% predicted</td>
</tr>
<tr>
<td>III – Severe COPD</td>
<td>FEV₁ 30 – 50% predicted</td>
</tr>
<tr>
<td>IV – Very severe COPD</td>
<td>FEV₁ &lt; 30% predicted</td>
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A defining characteristic of COPD at all levels of severity is an FEV₁/FVC ratio of less than 70%.
**Review of Basics**

- Insure that demographic data is correct
- Remember that weight is not a measured value – pick your battles.
- Measure lung age only with smokers and prior smokers – it is the most inaccurate measurement
Modalities of Pulmonary Function Testing

1. Spirometry
2. Pre and post bronchodilator
3. Lung volumes – complete testing
4. Diffusing lung capacity – using carbon monoxide

CPT codes

- 94010: Simple spirometry, including graphic record, total & timed VC, expiratory flow rates. No bronchodilator. Includes 94375.

- 94060: Spirometry as with 94010 but with pre/post bronchodilation.

Reimbursement rates vary across the country ~ $35.00.

Practice Time!
References

- Global Initiative on Chronic Obstructive Lung Disease (GOLD)
  http://www.goldcopd.com
- National Asthma Education and Prevention Program (NAEPP)
  National Heart, Lung, and Blood Institute
  http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf

References


References

References


Thank you!

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