Basic Interpretation of Spirometry

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COPD Team
Aims

• When to do spirometry
• When not to do spirometry
• Definition of terms
• Different patterns in spirometry
• Problems
• Interpreting Time/Volume graphs
Spirometry

Spirometry is a method of assessing lung function by measuring the volume of air a patient can expel from the lungs after maximal inspiration.
WHY WE DO IT!

- Diagnosis confirmation
- COPD classification
- Disease progression
- Response to treatment
- Health Promotion (Smoking Cessation)
- Targets
FINDING THE MISSING MILLIONS

National Clinical Strategy recommends “A diagnosis of COPD should be confirmed by quality assured spirometry…..”
When not to perform spirometry

• Inadequate training
• Inadequate equipment
• Lack of quality control
• Contra-indications
• During or immediately after an exacerbation
Contra-indications

- Haemoptysis
- Pneumothorax
- Unstable cardiac status
- Aneurysm
- Recent eye surgery
- Recent thoracic or abdominal surgery
- Acute disorders: D&V, Exacerbations
How we do it!

• Equipment / spirometers / syringes
• Cleaning
• Temperature
• Calibration/Verification checks
• Filters
Patient preparation

- Pre-test information
- Documentation
- Patient comfort
- Explanation/demonstration
- Seated, chair with arms
Definition of terms

- $FEV_1$
- $FVC$
- $VC$ (RVC, SVC, EVC)
- Ratio $FEV_1/FVC$ or $FEV_1/VC$
\( \text{FEV}_1 \) (Forced Expiratory Volume in 1 second)
FVC

The maximum volume of air exhaled as rapidly, forcefully and completely from maximum inspiration.
Relaxed Vital Capacity

The maximum volume of air expelled during a relaxed exhalation from maximum inspiration
FEV₁% or Ratio of FEV₁ to FVC

FEV₁/FVC x 100

The proportion of air exhaled in one second

This percentage is important in identifying airways obstruction
Airflow Obstruction

Definition of airflow obstruction:
FEV$_1$ <80% predicted
and
FEV$_1$/FVC <70%
Definition of Chronic Obstructive Pulmonary Disease (COPD)

COPD is predominantly caused by smoking and is characterised by airflow obstruction that is not fully reversible. The airflow obstruction does not change markedly over several months but is usually progressive in the long term.

(NICE 2010)
COPD Classification

NICE Guidelines

- Mild COPD  \( FEV_1 \geq 80\% \) predicted
- Moderate COPD  \( FEV_1 80-50\% \) predicted
- Severe COPD  \( FEV_1 50-30\% \) predicted
- Very Severe COPD  \( FEV_1 <30\% \) predicted
Different Patterns in Spirometry

• Normal
• Obstructed
• Restricted
• Combined/Mixed
Normal spirometry trace
Restrictive Spirometry

**Restrictive**: due to conditions in which the lung volume is reduced, eg fibrosing alveolitis, scoliosis. The FVC and FEV1 are reduced proportionately.
Reporting Spirometry

• Results should be the greatest values achieved from 3 technically acceptable blows. (FEV$_1$ within 5%)

• *Poorly performed spirometry is worse than no spirometry!*
QUALITY?

National strategy cites an example:

31% of spirometry measurements in 38 practices in Rotherham met the required standard of 3 readings within 5% (in contravention of BTS and GOLD spirometry standards)
New Guide to Spirometry!!!

• A Guide to Performing Quality Assured Diagnostic Spirometry

• www.pcc.cic.org.uk
Problems!

- Slow start
- Short Blow
- Cough
- Leaks around mouthpiece
- Sub-maximal effort
- Unable to achieve 3 acceptable results
- Inadequate rest between attempts
# Parameters of Lung Function

<table>
<thead>
<tr>
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<th>Normal</th>
<th>Obstructive</th>
<th>Restrictive</th>
<th>Combined</th>
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<tbody>
<tr>
<td>FVC</td>
<td>&gt;80%</td>
<td>Normal</td>
<td>Reduced</td>
<td>Reduced</td>
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<tr>
<td>FEV(^1)</td>
<td>&gt;80%</td>
<td>Reduced</td>
<td>Reduced</td>
<td>Reduced</td>
</tr>
<tr>
<td>FEV(^1)/FVC</td>
<td>&gt;70%</td>
<td>Reduced</td>
<td>Normal/High</td>
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Reading the tracing

- Is the spirometry valid?
- Check sex/age/height/weight/BMI
- Check tracing for problems
- Identify ACTUAL ratio ? obstruction
- Identify FEV1 and % predicted
- Check VC and FVC ? Air trapping ? Reduced volumes
- Remember to use largest measurement from valid blows, (these may not all be from one blow)
- Do the figures fit with the tracing?
- Interpret together with history, symptoms and medication
Name: ___________________________ I.D: __________
Sex: Female  Age: 29
Factor: 100
Height: 165cm  Weight: 70 kg  BMI: 24

FEV1  FVC  PEF  Var Quality  Time:  Date:
Base  3.45  3.95  413  0%  Poor effort  09:00 08-04-07
Base  3.45  3.93  389  0%  Poor effort  09:00 08-04-07
Base  3.43  3.96  459  0%  Good blow  09:00 08-04-07

Variation is based on FEV1

Best Spirometry Result:

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<tr>
<th></th>
<th>Base</th>
<th>%Pr</th>
<th>Min</th>
<th>Pred</th>
<th>Max</th>
<th>Post</th>
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<td>105</td>
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<td>2.57</td>
<td>3.19</td>
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<tr>
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<td>107</td>
<td>2.96</td>
<td>3.67</td>
<td>4.38</td>
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<tr>
<td>PEF</td>
<td>413</td>
<td>97</td>
<td>337</td>
<td>426</td>
<td>515</td>
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<td></td>
<td>L/M</td>
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<tr>
<td>FEV1/FVC</td>
<td>87</td>
<td>104</td>
<td>73</td>
<td>84</td>
<td>94</td>
<td></td>
<td></td>
<td>%</td>
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<td>MEF75</td>
<td>6.87</td>
<td>111</td>
<td>3.97</td>
<td>6.19</td>
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<tr>
<td>MEF50</td>
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<td>84</td>
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<tr>
<td>MVV(ind)</td>
<td>129</td>
<td>108</td>
<td>96.5</td>
<td>120</td>
<td>143</td>
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Variation is based on FEV1
Normal Values: ECCS (Adult);
Zapletal, Solymar, Coleswell (Child)
Results at BTPS.

Technician: _____________________
Training

- Do not perform spirometry without training
- ARTP (www.artp.org.uk)
- EQUIP (www.essexequip.nhs.uk)
- Education for health (www.educationforhealth.org.uk)
Thank you for listening

Any Questions?