Understanding the Capacity for Life

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OVERVIEW

WHO, What, Why, How

What it is & what it isn’t

Case studies – basic interpretation
• PULMONARY REHABILITATION
• LONG-TERM OXYGEN THERAPY
• NON-INVASIVE VENTILATION
• ADVANCE CARE PLANNING
• SPIROMETRY
HISTORY

1846
John Hutchinson develops the first spirometer
Hutchinson J. (1846). Med Chir Trans; 29: 137–252

1947
First clinical application using FEV1 & FVC

1960
European Community for Coal & Steel issues recommendations (males)
HISTORY

2005

ATS/ERS Joint Committee compile reference values

1991

ATS suggests ‘restrictive pattern’

Convex appearance of flow volume loop
Everyone is not the same

**SIZE & SHAPE**

Adding clinical context:
Overlap/range of ‘normal’ varies
A method of assessing lung function by measuring the volume of air a pt is able to expel from the lungs after maximal inspiration.

It can differentiate between obstructive airway disorders (asthma COPD) & restrictive diseases where the size of the lung is reduced (fibrosis).

It can also used to determine severity of COPD.
BUT....
THEY DO NOT ACT ALONE

THEY ACT ONLY TO SUPPORT OR EXCLUDE A DIAGNOSIS

A COMBINATION OF THOROUGH HISTORY & PHYSICAL EXAM, SUPPORTING LABORATORY DATA WILL HELP ESTABLISH A DIAGNOSIS
“Excellent health statistics - smokers are less likely to die of age related illness”
WHY DO SPIROMETRY?

DIAGNOSIS

SCREENING

DISEASE PROGRESSION

ASSESS TREATMENT

SMOKING & SYMPTOM
The rate at which the lung changes volume during forced breathing manoeuvres

Begins with a full inhalation, followed by forced expiration that rapidly empties the lungs

Expiration continued until a plateau is reached
THE FVC MANOEUVRE

Exhalation

Inhalation

FEV1

VOLUME (LITRES)

FLOW (LITRES PER SECOND)

TIME (SECONDS)
### Spirometry

<table>
<thead>
<tr>
<th></th>
<th>Ref</th>
<th>Meas</th>
<th>% Ref</th>
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<tbody>
<tr>
<td>FEV1</td>
<td>4.69</td>
<td>5.03</td>
<td>107</td>
</tr>
<tr>
<td>FVC</td>
<td>5.43</td>
<td>5.80</td>
<td>107</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>85</td>
<td>87</td>
<td>107</td>
</tr>
<tr>
<td>PEF</td>
<td>589</td>
<td>620</td>
<td>105</td>
</tr>
<tr>
<td>FEF50%</td>
<td>362</td>
<td>330</td>
<td>91</td>
</tr>
<tr>
<td>FEF75%</td>
<td>166</td>
<td>156</td>
<td>94</td>
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<tr>
<td>FEF25-75%</td>
<td>314</td>
<td>304</td>
<td>97</td>
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<tr>
<td>FET100%</td>
<td>190</td>
<td>2.82</td>
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</tbody>
</table>

**Comments:**

Good effort
unable to exhale for 6 seconds on spirometry but reproducible results obtained.
Limitation of Peak Flow

- Normal PF in mild COPD
- Low PF in mod-severe COPD
- Limited use
- Variable
a) normal subject

b) obstructive airway disease (e.g. asthma);

c) severe obstructive disease (e.g. emphysema)

d) restrictive lung disease (e.g. pulmonary fibrosis)

e) fixed major airway obstruction (e.g. carcinoma of the trachea).
ASTHMA

FEV₁

ratio

COPD

FEV₁

ratio

RESTRICTIVE

FEV₁ & FVC,
or normal ratio

(also RV & TCL)
CONFOUNDERS
AGE, SEX, ETHNICITY, HEIGHT

STEP one
Validity

STEP two
Pattern

STEP three
Grade the severity

CLINICAL CONTEXT
### COPD OR ASTHMA?

<table>
<thead>
<tr>
<th>Measure</th>
<th>PRED</th>
<th>MEAS</th>
<th>% PRED</th>
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</thead>
<tbody>
<tr>
<td>FVC (L)</td>
<td>3.66</td>
<td>3.05</td>
<td>83</td>
</tr>
<tr>
<td>FEV1 (L)</td>
<td>2.99</td>
<td>1.66</td>
<td>55</td>
</tr>
<tr>
<td>FEV1/FVC (%)</td>
<td>83</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>PEF (L/min)</td>
<td>390</td>
<td>298</td>
<td>76</td>
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</table>
# COPD Spirometry

<table>
<thead>
<tr>
<th></th>
<th>PRED</th>
<th>MEAS</th>
<th>% PRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC (L)</td>
<td>3.85</td>
<td>2.67</td>
<td>69</td>
</tr>
<tr>
<td>FEV1 (L)</td>
<td>3.04</td>
<td>0.54</td>
<td>18</td>
</tr>
<tr>
<td>FEV1/FVC (%)</td>
<td>79</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>PEF (L/min)</td>
<td>484</td>
<td>166</td>
<td>34</td>
</tr>
</tbody>
</table>
A significant response
Diagnostic with asthma
Defined as both a >20% rise and >400ml increase in FEV1
RESTRICTIVE SPIROMETRY

[Graphs showing flow versus volume for restrictive spirometry with two different curves.]
### Mixed Spirometry

<table>
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<tr>
<th>Function</th>
<th>PRED</th>
<th>MEAS</th>
<th>% PRED</th>
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<tbody>
<tr>
<td>FVC (L)</td>
<td>3.64</td>
<td>1.50</td>
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<td>FEV1 (L)</td>
<td>2.15</td>
<td>0.81</td>
<td>38</td>
</tr>
<tr>
<td>FEV1/FVC (%)</td>
<td>83</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>PEF (L/min)</td>
<td>318</td>
<td>251</td>
<td>79</td>
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</tbody>
</table>

**Obstructed/Restricted Spirometry**
Confirms chronic airflow limitation but limited value distinguishing between asthma with fixed airflow obstruction, COPD & ACOS

Single visit spirometry is NOT always a confirmation of diagnosis

ICS & LABA blurred picture
RESTRICTIVE SPIROMETRY

CASE STUDY:
- Newton
- 59 years
- Coughing / smoking
### CASE STUDY:
- Newton
- 59 years
- Coughing / smoking

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pred</th>
<th>Meas</th>
<th>% Pred</th>
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</thead>
<tbody>
<tr>
<td>FVC (L)</td>
<td>3.74</td>
<td>1.45</td>
<td>39</td>
</tr>
<tr>
<td>FEV1 (L)</td>
<td>3.32</td>
<td>1.33</td>
<td>40</td>
</tr>
<tr>
<td>FEV1/FVC (%)</td>
<td>87</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>PEF (L/min)</td>
<td>416</td>
<td>368</td>
<td>89</td>
</tr>
</tbody>
</table>
Contraindications

- Respiratory Infection
- Haemoptasis of unknown origin
- Pneumothorax
- Recent abdo, chest or eye surgery
- Uncontrolled HT or PE
- MI in previous month
- Pain N & V (or middle ear infection)
- Confusion
Spriometry is essential assessment of suspected disease of airways

- Initial & subsequent
- Before & after treatment
- Early confirmation or exclusion
- Avoid needless therapy
- Avoid delay in initiating other investigations
If you can’t explain it *simply*, you don’t understand it well enough.

— Albert Einstein