What is spirometry?

Spirometry is used to measure lung volumes and air flow. Alongside clinical assessment, it is an essential tool used in the diagnosis, assessment and monitoring of Chronic Obstructive Pulmonary Disease (COPD), may contribute to the diagnosis of asthma and detect restrictive respiratory conditions.

Diagnostic Spirometry: National Register of certified professionals

As part of a phased introductory process starting in April 2017 all healthcare practitioners in England will be required to demonstrate that they are competent to perform and/or interpret spirometry and join a register of certified practitioners. The new scheme sets out how healthcare professionals performing and/or interpreting diagnostic spirometry should be trained, assessed and certified.

The key principles of the National register are:
- Diagnostic spirometry must meet the Association for Respiratory Technology and Physiology (ARTP) standards.
- Education and training must be flexible and accessible
- Assessment and verification process must include recognition of prior experience and competence

How to become accredited on the National Spirometry Register

1. Register with the Association for Respiratory Technology and Physiology (ARTP) to perform (and ideally, interpret) spirometry.
2. Complete accredited training (full details below).
3. Complete 2 years of supervised practice.
4. Be assessed by an independent assessor.
5. Be declared competent.

Types of spirometry testing

- Baseline testing: Used to investigate lung function where diagnosis has not been established.
- Post-bronchodilator testing: Investigative to diagnose obstructive conditions where baseline spirometry shows an obstructive pattern.
- Monitoring: To monitor clinical progress in diagnosed asthma and COPD.
- Reversibility testing: May help to differentiate asthma from COPD.

What equipment is required to conduct spirometry?

- Spirometer (must meet ISO standard 26793).
  - Small hand-held meters which provide digital readings (but no visual display) are a cheap option which may be useful as a screening tool to identify people with abnormal readings who should be assessed by full diagnostic spirometry.
  - One-way disposable mouthpieces and nose clips.
  - Bacterial and viral filters (selected patients with any risk of infection).
  - Accurate height measures – calibrated according to manufacturer’s instructions.
  - Short-acting bronchodilators for reversibility testing and suitable means for delivery (volumetric/ nebuliser).

Contraindications to spirometry testing

- Acute disorders such as nausea and vomiting
- Conditions that may cause serious consequences
- Any condition which may be aggravated by forced expiration
- Active infection e.g. AFB positive TB until treated for 2 weeks
- Poor intake of breath
- Poor cough during procedure
- Cough during procedure
- Recent surgery (abdominal, thoracic, neurosurgery, eye surgery)

Sensors should be cleaned and service/maintenance processes carried out regularly according to the manufacturer’s instructions and in line with local and national guidance for infection control and equipment maintenance.

Adjusting Caucasian reference values to other ethnic groups. To apply these, multiply predicted normal values by factors of 0.98 (volumetric/nebuliser) or 1.02 (volumetric)

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>FEV1</th>
<th>FVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong Chinese</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>North Indian and Pakistani</td>
<td>0.9</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Who should undertake spirometry?

Poorly performed spirometry is meaningless.

Spirometry should only be undertaken by healthcare professionals who are trained and competent (accredited) in performing (and ideally, interpreting) the test.

Regular updates and quality audits are fundamental to ensuring the quality of spirometry testing.

Accredited training courses include:–

- Institution
- Course

http://www.artp.org.uk/Association for Respiratory Technology & Physiology

The ARTP with the British Thoracic Society (BTS) offers a variety of training methods and an accreditation system to ensure acceptable standards of spirometry testing and interpretation.

http://www.educationforhealth.org/ Education for Health

Education for Health have a range of spiro training courses written by experts, including workshops for those who simply need to feel more confident recording accurate measurements. The spirometry modules are developed with the Association for Respiratory Technology & Physiology (ARTP) and supported by the British Thoracic Society (BTS).

FURTHER INFORMATION

https://www.cdc.gov/ncidod/dabs/bacterial/spiroregister.html

http://www.cpc-cic.org.uk/article/quality-assured-diagnostic-spirometry

http://dx.doi.org/10.4104/pcrj.2009.00054

Types of spirometry testing

- Baseline testing: Used to investigate lung function where diagnosis has not been established.
- Post-bronchodilator testing: Investigative to diagnose obstructive conditions where baseline spirometry shows an obstructive pattern.
- Monitoring: To monitor clinical progress in diagnosed asthma and COPD.
- Reversibility testing: May help to differentiate asthma from COPD.

Prospective research

- Predictors of COPD
- Spirometry in the community
- Impact of smoking
- Smoking cessation

What are the limitations of spirometry?

- Spirometry fails to capture subclinical abnormalities (e.g. early stages of COPD).
- Spirometry cannot identify patients with co-morbidities (e.g. chronic renal disease).
- Spirometry is not sensitive to changes in lung function over time.
- Spirometry does not provide information about the underlying mechanisms of respiratory diseases.

What measurements are undertaken using spirometry?

- Relaxed or slow vital capacity (VC): The volume of air that can be slowly expelled from the lung from maximal inspiration to maximal expiration.
- Forced vital capacity (FVC): The volume of air that can be forcibly expelled from the lung from maximal inspiration to maximal expiration.
- Forced Expiratory Volume in 1 second (FEV1): The volume of air that can be forcibly expelled from the lung from maximal inspiration to maximal expiration.
- FEV1/FVC ratio: The FEV1/FVC ratio is the FEV1 expressed as a percentage of the predicted value for any person of similar age, sex and height with adjustments for ethnic origin. FEV1/FVC ratio is used to classify the severity of COPD.
- Forced Expiratory Volume in 6 seconds (FEV6): The volume of air that can be forcibly expelled from the lung from maximal inspiration to maximal expiration in six seconds.

This measurement is sometimes used as an alternative for FVC. Spirometry is sometimes used instead of FEV1/FVC.

Abnormal spirometry is divided into restrictive and obstructive ventilatory patterns.

- Restrictive patterns appear in conditions where the lung volume is reduced e.g. interstitial lung diseases, scoliosis. The FVC and FEV1 are reduced proportionately.
- Obstructive patterns appear when the airways are obstructed e.g. due to asthma or COPD. The FEV1 is reduced more than the FVC.

Predetermined normal values can be calculated and depend on age, sex, height, mass and ethnicity. FEV1 is often expressed as a percentage of the predicted value for any person of similar age, sex and height with adjustments for ethnic origin. FEV1/FVC ratio is used to classify the severity of COPD.

Types of spirometry testing

- Baseline testing: Used to investigate lung function where diagnosis has not been established.
- Post-bronchodilator testing: Investigative to diagnose obstructive conditions where baseline spirometry shows an obstructive pattern.
- Monitoring: To monitor clinical progress in diagnosed asthma and COPD.
- Reversibility testing: May help to differentiate asthma from COPD.

Prospective research

- Predictors of COPD
- Spirometry in the community
- Impact of smoking
- Smoking cessation

What are the limitations of spirometry?

- Spirometry fails to capture subclinical abnormalities (e.g. early stages of COPD).
- Spirometry cannot identify patients with co-morbidities (e.g. chronic renal disease).
- Spirometry is not sensitive to changes in lung function over time.
- Spirometry does not provide information about the underlying mechanisms of respiratory diseases.