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). It contributes to the diagnosis of asthma and detect restrictive respiratory conditions.

What measurements are undertaken using spirometry?

- **Relaxed or slow vital capacity (VC)**: The volume of air that can be slowly expelled from the lungs from maximum inspiration to maximum expiration.
- **Forced vital capacity (FVC)**: The volume of air that can be forcibly expelled from the lung from maximum inspiration to maximum expiration.
- **Forced Expiratory Volume in 1 second (FEV₁)**: The volume of air that can be forcibly expelled from maximum inspiration in the first second.
- **FEV₁/FVC ratio**: The FEV₁ expressed as a percentage of the FVC (or VC if that is greater), i.e. the proportion of the vital capacity exhaled in the first second. It distinguishes between a reduced FEV₁ due to restrictive lung volume and that due to obstruction. Obstruction is defined as an FEV₁/FVC ratio less than 70%.
- **Forced Expiratory Volume in 6 seconds (FEV₆)**: The volume of air that can be forcibly expelled from maximum inspiration in six seconds.

FEV₁ is commonly used in the diagnosis and monitoring of COPD. The FEV₁/FVC ratio is used to assess airflow obstruction, with a ratio less than 70% indicating significant obstruction.

For investigative or reversibility testing patients should be advised to continue taking oral or inhaled corticosteroids but stop taking short-acting bronchodilators (SABA) for 4 hours, long-acting anticholinergic bronchodilators (LAMA) for 12 hours and long-acting Beta agonists (LABA) for 36 hours. For monitoring existing conditions patients should continue to take normal prescribed therapy.

Assess patient for contra-indications – see separate box.

Patients should be asked to:
- Smoke for at least 24 hours before the test
- Eat a large meal before the test
- Be vigorous exercise before the test
- Wear tight clothing

Patients should be asked to bring their inhalers with them to the appointment.

Immediately before the test patients should be advised to:
- Remove loose-fitting dentures
- Remove chewing gum
- Ensure bladder is empty

How is spirometry performed?

- Ensure that the equipment is ready and in working order verify according to manufacturer’s instructions.
- Record age, height and weight.
- Record height and weight.
- Record race using ethnic classification factors (see table below).
- Make sure the patient is sitting comfortably ideally in a chair with arms.
- Explain the procedure and advise the patient not to breathe into the mouthpiece with the teeth or tongue.
- Ensure there is a good seal around the mouthpiece.
- Have the patient learn how to cough for sufficient volume before the test.
- Ensure there are no gross leaks in the system.
- Encourage the patient to hold their breath between each blow.
- Have the patient perform a slow blow.

For a ‘short blow’ which has not demonstrated on the graph:
- Repeatability criteria are met when there is no more than 10% variability between each blow. Some spirometers will inform the user when this has been achieved.
- A maximum of 6 attempts is believed to be acceptable in any one session. If the patient is unable to achieve the quality criteria, record why this has not been possible and where appropriate use exemption code in the record.
- A further appointment may be required or referral for specialist assessment.
- Print out the numerical and graphical spirometry results and document the results using the template available in the practice system.
- Import (or scan) the spirometry results into the patient’s electronic health record.
- Inform patient of the results if you are qualified to interpret the findings or make an appointment for the patient to discuss the results and future treatment with their GP or an appropriate healthcare professional/trained in spirometry interpretation.

Contraindications to spirometry testing:

- Active infection e.g. AFB positive TB until treated for 2 weeks
- Conditions that may cause serious consequences to health if aggravated by forced expiration e.g. dissection/unstable aortic aneurysm, pneumothorax, recent surgery (abdominal, thoracic, neurosurgery, eye surgery)
- Suspected respiratory infection in the last 4-6 weeks requiring antibiotics or steroids
- Undiagnosed chest symptoms e.g. haemoptysis
- Any condition which may be aggravated by forced expiration e.g. prior pneumothorax, history of myocardial infarction, stroke or embolism in the last 3 months, previous thoracic, abdominal or eye surgery
- Perforated eardrum
- Acute disorders such as nausea and vomiting
- Confusion, communication problems

Types of spirometry testing:

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

What equipment is required to conduct spirometry?

- **Spirometer** (Must meet ISO standard 26783).
- 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 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 masks for delivery (volumetric/nebuliser).”

Calibration, verification and maintenance of spirometry equipment:

Calibration of spirometry test equipment should be performed using a certified 3 litre syringe and following the manufacturer’s recommended procedure. For a device to be within calibration limits it must read +/- 1% of true. Calibration should be verified prior to each clinic session or after every 10 patient (whichever comes first). A calibration log should be maintained.

Spirometers should be cleaned and serviced between use and regularly according to the manufacturer’s instructions and in line with clinical and national guidance for infection control and equipment maintenance.

Further information for patients:

http://www.arpt.org.uk/

Further information for staff:

http://www.pcrs-uk.org
Join the PCRS-UK http://www.pcrs-uk.org/join

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