STANDARD OPERATING PROCEDURE PERFORMING SPIROMTERY WITH OR WITHOUT REVERSIBILITY

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VALIDITY – All local SOPS should be accessed via the Trust intranet.

CHANGE RECORD

Version	Date	Change details
1.0	*-*	*New SOP.*
1.1	*02/12/20*	*Ivan Daleo is lead author.*
1.2	*11/04/22*	*Updated with added Covid IPC measures.*
1.3	*31/03/23*	*SOP reviewed and updated in full. References added and appendices removed. Approved at Primary Care Clinical Network Group (31 March 2023).*

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1. INTRODUCTION

Spirometry is a commonly used lung function test, intended to measure airflow and lung volume. Spirometry can be used to identify airflow obstruction, restriction, combined patterns of restriction and obstruction, and establish whether obstruction is reversible or fixed. It is widely accepted as a safe test. In primary care it is often used in the diagnosis and monitoring of conditions such as asthma and COPD, and can is a useful tool in the investigation of any undiagnosed respiratory symptom.

Tests carried out in primary care are more commonly expiratory measurements only. The patient is required to perform a number of different blows in order that measurements can be obtained for a number of parameters. Relaxed vital capacity (VC or EVC) is the total volume of air that can be exhaled in a relaxed manner from a position of full inhalation. Forced vital capacity (FVC), the total amount of air that can be exhaled from a position of full inspiration in a forced manner and the forced expiratory volume in 1 second (FEV1) the amount of air exhaled during the first second of a forced expiratory maneuver. A ratio of FEV1 to FVC or VC (whichever is greater) is also determined. These measurements are then compared to predicted or expected values, calculated according to the age, height, gender and ethnicity of the patient. Comparison of the actual values and predicted values enable recognition of airflow obstruction and or restriction. Reversibility testing also establishes whether airflow obstruction is fixed. When considered alongside patient history and presentation, spirometry informs diagnosis, monitoring and aids decision making regarding treatment and investigations.

Contraindications to spirometry that may inhibit the ability to perform the test or present a hazard to the patient or others, should any of them apply it is usually advisable to delay testing.

It is important to acknowledge that while SARS-CoV-2 infection still presents a challenge with respect to Infection Prevention and Control (IPC), other airborne or contact transmitted pathogens considerations (e.g., influenza, tuberculosis, HIV) have long presented a similar challenge, both in hospital and community settings. Practices should already have in place IPC procedures to minimize and ‘manage overall risk’.

Ideally patients should be six weeks free of any infection prior to spirometry testing. It is important also that patients are able to understand and comply with instruction.

2. SCOPE AND AIMS

This SOP will be used across all Primary Care services within Humber Teaching NHS Foundation Trust. It includes medical, registered, and non-registered staff who are permanent, temporary, bank, or agency/locum working within Primary Care who are carrying out spirometry.

3. DUTIES AND RESPONSIBILITIES

GP Clinical Forum

Develop, approve, implement and review the effectiveness of this SOP.

Service Managers, Matrons and Clinical Leads

Review and update this SOP.
Ensure dissemination and implementation of this SOP.

Users of spirometry equipment/training and competency of registered and unregistered health professionals

Spirometry should only be performed by Medical or Health Care Professionals who have undergone appropriate training at ARTP standards and who keep their skills up to date.

All health professionals who perform spirometry will have completed training by an ARTP approved training course, certified competent to perform spirometry and placed on the Association for Respiratory Technology and Physiology (ARTP) register.

Manufacturer information regarding cleaning, to include COVID-19 precautions, should be obtained and reviewed. Ensure that users are following the cleaning protocol and after each spirometry session.

Every spirometry should be performed with a single-use bacterial/viral filter in the circuit that meets ATS/ERS standard, these will need to be pre ordered.

Review of premises and room suitability to restart spirometry within these IPC and quality recommendations.

Ensure that the equipment is serviced regularly according to the manufacturer's instructions.

Ensure any problems encountered whilst working with the spirometer are reported.

4. INDICATIONS

The aim of performing spirometry is to:

- Detect the presence/absence of airway/ lung disease
- Quantify the extent of known disease
- Pre/post-surgery comparisons
- Determine effects of therapy
- Measure effects of occupational exposure
- Evaluate disability or impairment

5. EQUIPMENT

Prior to testing all equipment should be made readily available, checked it is fit for purpose and safe to use:

- Equipment is prepared for use
- All equipment used must be cleaned according to local infection control policy and manufacturer instructions.
- Equipment must be calibrated/ verified prior to use according to manufacturer instructions.
- All diagnostic procedures must be performed using a single patient use mouthpiece, bacterial/viral filter, and clean nose clip if available.

6. INFECTION CONTROL

It is difficult to establish the degree of risk of cross-infection via lung function testing. Risk is low but the potential is real. It is important to practice appropriate routine cleaning and decontamination of all non-disposable consumables, equipment, work surfaces and personnel with local policies in place, including cleaning protocols, cleaning logs, practicing good hand hygiene and appropriate use of personal protective equipment (PPE) as per recommended guidance. Healthcare professionals and patients should wash their hands before and after the test, using either hand gel or soap and water.

Most bacterial/viral filters offer protection against 99.99% bacteria and viruses, including COVID-19. These should be attached to the spirometer prior to the patient performing the test and disposed of after each patient.

When planning spirometry lists, if possible, patients with an infection should be booked at the end of the list, whereas immunocompromised patients should be at the start of the list. This will help mitigate the risk to other patients.

Spirometry should be conducted in a well-ventilated room to maximise airflow. A minimum of 6 air changes per hour in the room is recommended. There are High Efficiency Particulate Absorbing (HEPA) filters available which can filter most particulate matter, including COVID-19 particles. These can be purchased and, depending on the number of air changes in the room, can be set to clear the air within 15 minutes. This is not essential but depending on local protocols can be utilised to help reduce infection risk.

Pre-tests instructions

Patients should be correctly prepared for their appointment and be provided with relevant instructions prior to their appointment. Compliance with these instructions should be confirmed prior to testing.

The patient will be advised to avoid the following:

- Avoid smoking on the day of testing
- Consuming alcohol for at least four hours prior to the test
- Eating a substantial meal for at least 2 hours prior to the test
- Vigorous exercise for at least 30 minutes prior to the test3
- Wearing tight clothing that may restrict full chest and abdominal expansion
- To refrain from using their bronchodilators for the washout interval unless specifically instructed to do so. If bronchodilators have been taken prior to testing, record drug and time administered relative to testing in the report comments.

7. PATIENT PREPARATION

Patients should be greeted and invited through for testing. All staff involved with the patient should introduce themselves by name/role to the patient (and carer if appropriate). Prior to testing the patient's demographics should be checked, confirming the patient's correct name, date of birth, identification number and address.

8. CONTRAINDICATIONS

All patients should be assessed for any contraindications to testing to ensure they are safe to undergo spirometry. The majority of contraindications are relative but where there is potential for risk to occur, the benefit of performing the test should be compared to the potential risk and a decision made whether the benefit outweighs the risk. If any of the following contraindications apply, then testing may not be performed unless discussed with a senior member of staff or requesting physician. Some relative contraindications in secondary care may be absolute in primary care, depending on local protocols.

9. RELATIVE CONTRAINDICATIONS

Recommended wait times before lung function testing

Eye surgery	2-6 weeks
Unstable angina / angina attack	The use of sublingual GTN (glyceryl trinitrate) prior to testing
Recent MI	7 days
Pneumothorax	3 weeks
Brain surgery	3-6 weeks
Abdominal/ thoracic surgery	4 weeks
Vascular surgery	4-6 weeks
Nausea, vomiting, diarrhoea	clear for 48 hours
Middle ear infection	2 weeks once treated
Pulmonary embolism untreated	once treated with anticoagulants Haemoptysis of an unknown origin – rebook for 2 weeks
Stroke	once treated with anticoagulants
Suspected respiratory infection	4-6 weeks

10. ABSOLUTE CONTRAINDICATIONS

In some instances, there may be a greater risk to the patient by performing spirometry or pose a risk to others. Therefore, it is recommended that spirometry is avoided where possible in the following conditions:

- Active untreated TB
- Aneurysm aortic or cerebral >6 cm or bulging
- Untreated pulmonary embolism

11. TEST PROCEDURE

1. Explain the purpose and nature of the test to the patient and gain their consent either verbally or written e.g. “There is two parts to this test that will measure how much air you can fully exhale in a slow manoeuvre and then a fast manoeuvre”
2. Measure patients’ height, preferably standing height using a stadiometer.
3. Weight should be measured – without outdoor clothing or shoes using calibrated scales and recorded to the nearest 0.1kg
4. Make sure the following are correctly recorded:
    - Patient demographics (name, DOB, relevant identification number), ethnicity, birth sex
    - Age should be recorded
    - Smoking history (if smoked on day of test note time of last cigarette)
    - Medication including dose and time of any inhaled or oral medication prior to testing that may be applicable to the performance of spirometry.
5. Patient should be asked to loosen any tight-fitting clothing, where this is obviously restricting full chest wall and abdominal movement
6. Dentures should routinely be left in situ; however, it may be advisable for the patient to remove loose fitting dentures if these interfere with mouth seal. Ask the patient to sit upright in a chair with arms with feet flat on the floor and legs uncrossed
7. Instruct the patient how to perform the test, starting with an SVC manoeuvre and demonstrate if necessary

Relaxed Vital Capacity

1. Explain the test procedure to the patient, demonstrating as necessary e.g. *"Take a deep breath in until you are completely full and then gently breathe all the way to empty, making sure to blow out for as long as you possibly can*"
2. Connect the mouthpiece and/or filter to the spirometer and use a nose peg (essential for VC) or ask the patient to pinch their nose.
3. When the patient is on the mouthpiece, they should ensure they have a good tight lip seal and their tongue is not obstructing the mouthpiece.
4. Remove the patient from the mouthpiece.
5. Examine the effort for any technical errors
6. Allow the patient to rest for a minimum of 30 seconds before continuing
7. Repeat procedure as above; a minimum of 3 technically acceptable attempts should be performed and two reproducible efforts must have been achieved, a maximum of 8 attempts may be performed if required

Forced Vital Capacity

1. Explain the test procedure to the patient with a visual demonstration as necessary e.g. "*take a deep breath in until you are completely full and then blow out as hard and as fast as you can until you are completely empty*"
2. Connect patient to the mouthpiece; nose clips not required.
3. Remove the patient from the mouthpiece.
4. Examine the effort for any technical errors
5. Allow the patient to rest for a minimum of 30 seconds before continuing
6. Repeat procedure as above. A minimum of 3 technically acceptable attempts should be performed and 2 reproducible efforts must be achieved, a maximum of 8 attempts may be performed if required.

Bronchodilator response

A bronchodilator response may be performed if there is a question regarding the diagnosis and if the following conditions are met:

- Patient must be able to perform technically acceptable and reproducible baseline spirometry
- Patient has withheld inhalers as instructed; otherwise true baseline will not be established.
- If the patient is unable to withhold their inhalers, baseline spirometry only should be performed with appropriate comments reported.
- Depending on the clinical question, if a patient has taken inhalers prior to testing and they are still obstructive this can provide enough information to aid the diagnosis/management plan.

A bronchodilator should be administered according to Humber Salbutamol PGD. The patient should wait a minimum of 15-20 minutes if given a short acting β2 agonist or 45 minutes for a short acting muscarinic antagonist prior to repeating spirometry.

12. REFERENCES

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