Ashford and St. Peter's Hospitals
NHS Foundation Trust

# STANDARD OPERATING PROCEDURE

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| **TITLE: Performance of Forced Spirometry in Children up to age of 18** | |
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| **RATIFIED BY**<br><br>Paediatric guidelines committee | **DATE**<br><br>18/12/24 |
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**PURPOSE**

The purpose of this SOP is to provide guidelines for performing paediatric spirometry using Vitalograph® Alpha or In2itive device, a specific spirometry device, in a standardized and accurate manner.

**AIM**

To provide a standard procedure to ensure Spirometry is conducted in accordance with ARTP guidelines and results are interpreted with a clinical history. 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 the effects of therapy.
- Evaluate disability or impairment.

**SCOPE**

This SOP applies to healthcare professionals who will be using Vitalograph® Alpha or In2itive device for paediatric spirometry tests on patients.

**COMPETENCIES**

Registered Nurse
Understanding of Trust Policies and protocols
Paediatric Spirometry course attendance.
ARTP registration is gold standard but not a necessity.

**PROCESS**

**Equipment and Materials**

- Vitalograph® Alpha or In2itive device
- 3L Calibration Syringe.
- Disposable Bacterial Viral Filters (BVF).
- Nose clip if patient can tolerate.
- Tissue paper and Wipes.
- Personal Protective Equipment (Gloves if required.)
- Calibrated weighing Scales
- Stadiometer.
- Chair
- Thermometer for room

**Quality control**

- Vitalograph spirometry machine calibration should be conducted at least daily when being used as per ATS / ERS Technical standards (2019).
- Vitalograph Spirometry machine calibration check should be conducted every 2 years with one person conducing a lung function daily for 10 consecutive days to ensure consistent readings are being obtained.
- Record of testing should be kept.
- Record room temperature on Spirometer if different to the one entered. If available enter pressure, altitude and humidity.

- Connect Vitalograph® device to the 3L calibration Syringe using a BVF and follow on screen instructions.
- Record Result. (Results should be within 3%)
- If calibration is confirmed it is ready to be used.
- If calibration confirms error – check connections, retry then contact Maintenance team if any concerns. Do Not use on patient if not calibrated correctly.

**Preparation for the Test**

- Explain procedure to the child and family using age-appropriate language.
- Obtain verbal consent from the patient's parent or guardian.
- Enter the child's details on Vitalograph software including:
  - Name,
  - Date of Birth,
  - Weight,
  - Height,
  - Smoking Status,
  - Ethnicity,
  - Birth gender.
- Ensure the patient has not eaten a heavy meal, conducted vigorous exercise or been smoking for 1 hour beforehand.
- Verify the patient's details are entered into spirometer accurately.
- Ensure the patient is well prior to conducting the test.

**Contraindications for Spirometry**

- Active infection – AFB positive TB (until treated for 2 weeks)
- Conditions that forced expiration may cause serious consequences such as
  - Pneumothorax
  - Recent abdominal surgery
  - Neurosurgery
  - Eye Surgery
- Respiratory infection requiring antibiotics within 4 – 6 weeks or if needed steroids.
- Undiagnosed chest symptoms including:
  - Haemoptysis
  - Stroke or embolism in last 3 months
- Perforated Ear drum
- Acute disorders such as nausea and vomiting.

**Performing the Test**

- Ensure good hand hygiene – follow trust protocols throughout.
- Ask child to sit upright, maintaining good posture. Feet should be flat on the floor or on a stall. (No slouching permitted.)
- Inform child on how to conduct the test prior to starting.
- Place a Bacterial Viral Filter (BVF) on the Vitalograph® prior to starting test.
- Place a nose peg on child if tolerated. If used for one test must use for all tests for consistency.

- Instruct the child to take a deep breath in then exhale forcefully into the Vitalograph device BVF until they feel lungs are empty, ensuring the mouthpiece is between teeth with lips tightly sealed around the mouth piece, ensuring tongue is not obstructing the mouthpiece.
- Remove the mouthpiece from the patient.
- For younger children, if incentives are available such as blowing candles, use these to encourage exhalation.
- Confirm good technique and make adaptions if needed to posture, exhalation technique to ensure the best reading possible.
- Repeat at least 3 times, ensuring consistent and reproducible results.
- Allow rest in between attempt to prevent fatigue – at least 30 seconds between attempts.
- Maximum attempts are 8 and ideally have 2 reproducible efforts.

**Bronchodilator response**

- To be performed if unsure of diagnosis and patient can perform an acceptable and reproducible baseline test.
- Following a baseline spirometry test administer a bronchodilator as per local policy. (400mcg of Salbutamol) via appropriate spacer.
- Patient should wait a minimum of 15 – 20 minutes following bronchodilator.
- Enter bronchodilator, dose and mode in post-test comments.
- Repeat the forced spirometry manoeuvres as per above.

**Reporting results**

- Volumes expressed In Litres (L)
- Testing should continue until three technically acceptable tests have been achieved and reproducibility criteria have been met or reached maximum number of attempts.
- The best FEV1, FVC and PEF in 3 acceptable forced manoeuvres is reported.
- FEV1/FVC should be calculated using greatest FEV1 obtained.
- Results should be interpreted by a qualified healthcare professional, considering the patient's medical history and symptoms, by those who have qualification to do so.
- Results should be saved and acted up on appropriately in accordance with local policy.

**Infection control**

- All equipment should be cleaned according to local infection control policy and manufacturer instructions.
- Equipment should be cleaned between patients.
- BVF should be disposed of between patients and a new one ready for the next patient.
- Ensure good ventilation in the room with windows open if suitable during the test.

**RESPONSIBILITIES**

- To ensure an accurate Spirometry test is completed and results are then interpreted along side the clinical history of the patient.
- To ensure Equipment is maintained and serviced annually.

**RISKS**

- Spirometry is a safe procedure however sometimes patient may feel dizzy, faint, shaky, sick or tired for a short period afterwards.
- Not to conduct Spirometry on those with contraindications – unless discussed and agreed with clinician.

| MITIGATION FOR RISKS |
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| • Ensure test is only conducted if there are no contraindications (as stated in process area)<br>• Ensure test is conducted sitting down.<br>• To wait minimum of 30 seconds between attempts to reduce event of side effects. |

**Appendix A - ARTP Lung Function Reporting Document 2020 Author: Peter Moxon (On behalf of the ARTP Standards Committee)**

| Acceptability | Reproducibility |
|---|---|
| Efforts/trials must be free from artefact | A minimum of 3 efforts/trials |
| No cough within the first second | A maximum of 8 efforts/trials. After 8 attempts the probability of getting a better result is significantly reduced. Do not reject results, comment on repeatability and report best efforts. |
| Rapid rise to PEF (Flow Volume Loop). The highest reading of at least 3 technically acceptable blows should be recorded. A poorly co-ordinated start to the manoeuvre, indicated by a rise time of 10-90% of PEF of > 150ms or a back extrapolated volume of > 5% of the FVC or 0.1L if the FVC is < 2.0L. In subjects | The two largest values of FVC must not differ by more than 150ml of each other The two largest values of FEV1 must not differ by 150ml of each other. PEF-approximately 90% of subjects can achieve three PEF measures within 30 L/min (0.5L/s), 95% of subjects are within 40 L/min. Maximum number of 5 attempts for PEF. |
| No early termination of expiratory effort, plateau reached (the volume–time curve shows no change in volume (<0.025 L) for last 1 second of the test).<br>Note that if plateau has not been achieved the FEV1 may still be of some use. Early termination is not a reason to eliminate all data obtained as indices such as FEV1 may not be affected and will still be valid. | For those with an FVC of ≤1.0 L, the two largest FVC and FEV1 must be within 100ml of each other |
| No obstruction of the mouthpiece with the tongue, distortion of mouthpiece due to excessive biting or obstruction by the teeth. | The chosen results should be the greatest values from three technically acceptable tests. FEV1 and FVC may be taken from different manoeuvres. |
| No leak at the mouth (consideration must be given to patients with neuromuscular weakness and those with facial palsy | |
| No extra breath taken during effort. | |
| Maximal inspiration to TLC prior to forced expiratory effort. | If the maximum FVC is followed immediately by a full inspiration back to TLC and recorded as a single manoeuvre, then the FIVC must not exceed FVC by more than 100mls or 5% of the FVC, whichever is greater. If FIVC exceeds FVC by more than this, then it suggests the blow did not start from TLC |