NHS
Guildford and Waverley
Clinical Commissioning Group

MICRO SPIROMETRY

Background

Micro-spirometry (measurement of FEV1/6) using a handheld spirometer is a quick and easy alternative to formal spirometry (FEV1/FVC). Batt, Kim et al (2014) included a total of 10,018 subjects demonstrating FEV_1/FEV_6 showed excellent accuracy in diagnosing airflow obstruction using $FEV_1/FVC < 0.70$ as a reference. In comparison with control subjects and those positive by FEV_1/FVC alone, subjects positive by FEV_1/FEV_6 alone had greater gas trapping and airway wall thickness, worse functional capacity, and a greater number of exacerbations on follow-up. It was concluded that FEV_1/FEV_6 can be substituted for FEV_1/FVC in diagnosing airflow obstruction and may better predict COPD-related pathology and morbidity

Previous meta-analysis (2009) also showed that it is an acceptable surrogate to use FEV1/6. Sensitivity for detecting COPD has found to be 89% and specificity 0.98%. The process has also been found to be more comfortable and acceptable to patients that measuring FVC.

Indications

Micro spirometry can be used for

1. Case finding (COPD)
2. Monitoring (COPD)

BUT should NEVER be used for DIAGNOSIS

3. Asthma

1. CASE FINDING

AIM

To find patients with early signs of airways obstruction in their lungs, in order to find the missing millions, who may have COPD

- For people over 35yrs who

- Smoke or history of smoking with respiratory symptoms

- Have had bronchitis/respiratory tract symptoms

Note that, if COPD is being considered as a diagnosis, then screening or diagnostic spirometry should be done at least 4–6 weeks after the resolution of acute symptoms.

Consider patients with other chronic conditions, such as diabetes and heart disease, as very few people will have COPD alone.

Minor illness surgeries and new patient checks also offer good opportunities.

A questionnaire can be used to identify those for testing with a micro spirometer

E.g. The GOLD 'Could it be COPD?' questionnaire

Do you cough several times a day?
Do you bring up phlegm or mucus?
Do you get out of breath more easily than others your age?
Are you older than 40yrs?
Are you a current or ex smoker?
Three or more positive answers are indicative of COPD and simple breathing tests should be done

(PCRS -UK Opinion sheet on screening and case finding)

A study by Tinkelman DG et al 2007, suggested that using screening questionnaires and spirometry in general practice may yield 10-20% undiagnosed COPD cases.

The lower limit of normal (LLN) of FEV_1 is 80% predicted.

If FEV_1 value only is available, then this can be compared with the LLN charts, which are available.

OUTCOME

FULL spirometry testing will be required if the FEV_1 is less than 90% predicted and the FEV1/FVC6 is less than 75% predicted OR the patient is symptomatic

The patient should be invited for quality assured spirometry for any finding that is below the Lower limit of normal (LLN) values.

WARNING re case finding

COPD should not be diagnosed on a chest x-ray, but requires post bronchodilator spirometry

People with significant ongoing symptoms suggesting COPD should be considered for full diagnostic spirometry.

(Mild obstruction in COPD is defined as FEV_1 of greater than 80% of normal, but with a ratio FEV_1/FVC of 70% of less and ongoing symptoms)

2. MONITORING COPD

The FEV_1 does not vary greatly in COPD and is not an indicator of severity in acute exacerbation of COPD, but is a good prognostic indicator of degree of obstruction in people with COPD.

QOF recommend FEV_1 annually, not full spirometry nor further FVC or FEV1/FVC.

NICE recommends FEV_1 annually.

Major prognostic indicators look for FEV_1 alone and NOT other parameters e.g. BODE, DOSE

CONSIDER: A patient attends and is more breathless with COPD.

Potential causes may be-

PE, CA, Anaemia, HF, Pneumonia, Anxiety, Bronchiectasis, Pneumothorax, Pleural Effusion, Deconditioning

None of these are picked up from measuring the FEV_1

Therefore, once diagnosis has been confirmed with post bronchodilator spirometry and spirometry performed at the first annual review, future reviews could include the FEV_1 obtained from micro spirometry. This would leave more time to listen to patients, to react to their symptoms, check inhaler technique and allow a quality review to take place.(Holmes S & Scullion JE 2014)

The FEV_1 result should be compared to the previous year, to assess for example a quick decline, and if further action required.

3. ASTHMA

Micro spirometry can be used at the time when the patient is symptomatic, measuring the FEV_1 before and after treatment.
A rise of 12% and at least 200mls with time or treatment is suggestive of Asthma.
An increase of FEV_1 of 400mls is strongly suggestive of Asthma

(SIGN 153. British guideline on the management of Asthma 2016)

The Asma1 which is available, measures FEV1 and PEF, this could be used instead of the standard PEF meter

CALIBRATION/ VERIFICATION

The micro spirometer must have been checked for verification, to ensure accuracy.

Biological check

Perform an FEV1 on the same person for 10 days, at approx. the same time of day. Obtaining the best of 3 results and ensuring the best 2 readings are within 100mls

Add the 10 best results together

Divide by 10, to give the mean

Calculate plus and minus 5%, to create a biological FEV1 range.

A biological check should take place weekly with the result being within the biological range.

Keep a log of the verification checks

See Appendix 1

TECHNIQUE FOR USE OF MICRO SPIROMETER

The patient should be seated for the procedure

Check the patients age, height and sex and enter results into the micro spirometer

Attach a one way mouthpiece to the micro spirometer

Ask patient to fully inhale, place mouth around the mouthpiece, ensure a firm seal, then maximally exhale as rapidly as possible for 6 seconds

Repeat the test 2 more times, noting each result, until the best 2 results are within 100mls ideally (and certainly no more than 150 mls in the occasional highly variable patient).

Comments to be recorded in patient records, re variable effort, or problems experienced e.g. coughing, poor mouth seal, insufficient inspiration, inhaled medications taken pre-test.

CLEANING

Clean the micro spirometer as per manufacturer guidelines.

Use a new one way mouthpiece for each patient.

Do not perform micro spirometry if the patient currently has an infection or open TB

PEF Meters

Verifying equipment for accuracy is important, as decisions re diagnosis and management may be made on the result.

Therefore, we should consider checking PEF meters that we use.

A suggested activity, is to collect all the PEF meters in your practice. One person should then perform a peak flow on all the PEF meters and record all the results. Review the variance between all the best readings and you may be amazed at the differences there are.

Next step-obtain a new PEF meter, one person should then create a biological range.

-Perform PEF, best of 3, on 10 separate days, at the same time of day (within a few hours)

-Add the 10 best results together, divide by 10 to get the mean, then calculate the range plus or minus 5%.

-Monthly (or at least 3 monthly) the PEF meters should be checked, to see if the results remain within the created range.

Micro spirometers

Simple hand held spirometers could include the following FEV6, Micro1, Asma1 and PiKo-6 although this list is not extensive.

REFERENCES

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Martinez FJ, Raczek AE, Seifer FD, et al. Development and Initial Validation of a Self-Scored COPD Population Screener Questionnaire (COPD-PS). *COPD*. 2008;5(2):85-95. doi:10.1080/15412550801940721

Jing J, Huang T, Cui W, Xu F, Shen H. Should Fev1/Fev6 Replace Fev1/Fvc Ratio To Detect Airway Obstruction?: A Meta analysis. *Chest*. 2009;135(4):991-998.

NICE guidelines CG101-Chronic Obstructive Pulmonary Disease 2010

Tinkleman DG, Price D, Nordyke RJ, Halbert RJ COPD screening efforts in primary care: what is the yield Prim Care Resp J 2007:16(1):41-8

Primary Care Respiratory Society UK- Opinion Sheet Mo 38, COPD Screening &Case Finding 2010

Holmes S, Scullion JE, Effective Care Effective Communication - changing the face of COPD care (PCRS/ REUK, 2014)

SIGN 153 British guideline on the management of Asthma. A national clinical guideline Sept 2016

Appendix 1

Biological Control Data

1. Select biological controls – fit and healthy adults aged 18-65 years with no respiratory symptoms, no history of lung disease and not in the third trimester of pregnancy.
2. Establish normal range and variation of FEV_1, FVC and VC for the biological control by obtaining 20 measurements over 10 sessions on different days. Record data on data sheet.
3. Obtain the mean ± SD for each index and plot these on a graph with the mean value and ± 1SD and ± 2SD
4. On subsequent measurements, obtain the FEV_1, FVC and VC for the control
5. Plot out the new data to ensure that values are within ± 1SD of the mean. If this is the case then the test on the subject can proceed.
6. If data are between ± 1SD and ± 2SD, then this should highlight that an error may have occurred. Recalibrate spirometer and check circuitry. Repeat data on biological control.
7. If error remains withdraw equipment from use

Maintain a log of:
Calibration and verification records
Repeatability of the FEV_1, FVC, VC and PEF [in terms of absolute (e.g. 50mL) and percentage variability]
Biological controls
Feedback from external reviewer service where used