Peak flow monitoring and microspirometry as aids to respiratory diagnosis in primary care

Dr Duncan Keeley Executive Committee Member, PCRS-UK

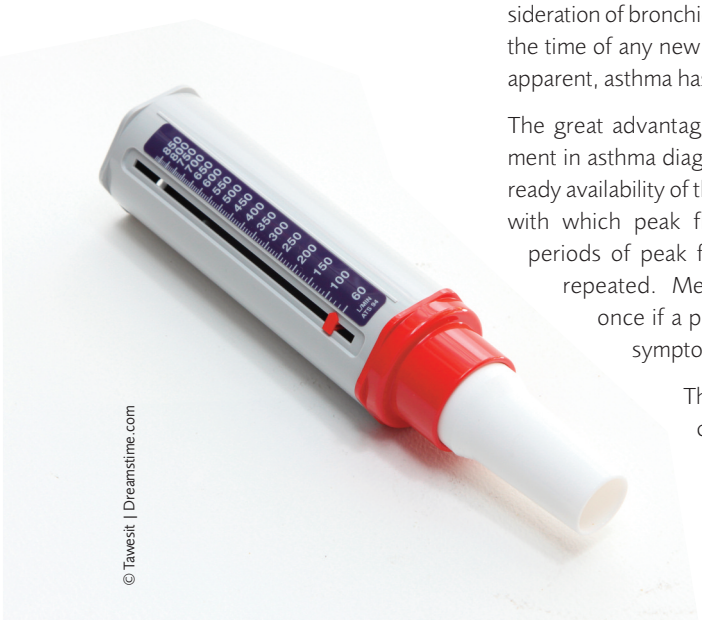
Introduction

The common chronic respiratory disorders diagnosed in primary care – asthma and COPD – are both characterised by airways obstruction. In asthma this varies markedly with time and treatment while in COPD the airways obstruction is typically fixed and permanent. Some people have fixed obstruction with some degree of reversibility – the so-called 'asthma COPD overlap syndrome'.

Diagnosis involves careful history taking and examination before moving on to physiological testing – being careful to keep in mind other respiratory and non-respiratory diagnoses that may cause breathlessness or cough. The pattern of symptoms over time and their response to treatment is also important, and earlier diagnoses should be re-interrogated if necessary. Always review an initial diagnosis – and consider referral to a specialist – if response to treatment is poor or there are atypical features. Chronic sputum production, for example, is highly unusual in asthma and even in COPD should prompt consideration of bronchiectasis. Get a chest X-ray at the time of any new diagnosis of COPD and, if apparent, asthma has definite atypical features.

The great advantages of peak flow measurement in asthma diagnosis are the low cost and ready availability of the equipment and the ease with which peak flow measurement – and periods of peak flow monitoring – can be repeated. Measurements can start at once if a patient presents with acute symptoms.

This article will cover the use of peak flow monitoring and microspirometry in primary care as aids to the objective demonstration of airways obstruction – reversible or otherwise.



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Peak flow monitoring

Repeated measurement and charting of peak expiratory flow has long been used for the diagnosis of asthma. Like many long established and simple aids to diagnosis, the published evidence base for its use is surprisingly sparse: a recent NICE assessment for a draft guideline on asthma diagnosis[1] cites a generally low and variable sensitivity but a specificity of up to 0.99 in adults and 0.80 children for peak flow monitoring in the diagnosis of asthma. This high specificity ('negativity in health') does mean, however, that clear evidence of peak flow variability is very good for ruling asthma in as a diagnosis, while sensitivity ('positivity in disease') improves if the monitoring is repeated – particularly across a period of exacerbation and remission of symptoms.

Who should do this?

Setting up peak flow monitoring with a patient suspected of having asthma requires the health professional to have the skills and the time to do it. Just like correct use of an inhaler, teaching correct use of a peak flow meter is not like falling off a log and a surprising number of health professionals don't know how to do it. Learn – it is

not rocket science either! Explaining and teaching effective peak flow monitoring does take a bit of time, but attention to correct diagnosis at the outset saves a great deal of time down the line. If there is not time to do the job at the first consultation, bring the patient back as soon as possible to go over it more thoroughly – but always get at least one peak flow and give them a meter and a chart before starting any treatment.

How to do it

Effective peak flow monitoring for diagnosis depends on:

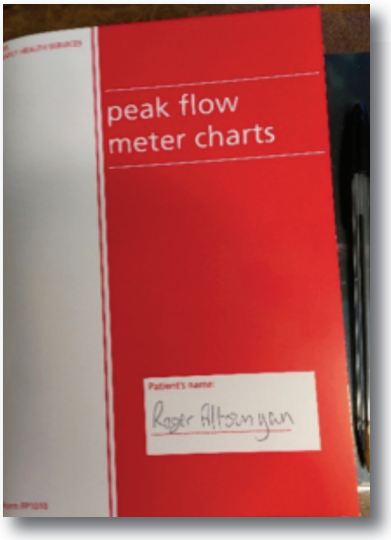
1. Explaining to the patient or parent how valuable a period of peak flow monitoring is in helping to make a correct diagnosis. "This is a bit of a palaver but it will really help us to get the right diagnosis and get you on to the right treatment to get you better."
2. Correct teaching of how to use the peak flow meter. Best of three hard fast blows and record the highest reading.
3. Having the patient or parent show you that they can perform peak flow measurements, correctly read the meter and correctly plot that number on a chart. They must be able to do all three to make a meaningful peak flow chart.
4. Taking measurements twice daily or more for a sufficient period – usually at least 2-4 weeks – at a time when symptoms are present. Peak flow charting when introducing a trial of treatment is particularly worthwhile. Encourage measurement when symptoms are marked and when they are better. Pre- and post-exercise readings are also useful.
5. Knowing how to identify abnormal variability in peak flow.
6. Repeating the testing period at a later date if symptoms persist but initial testing is inconclusive or the diagnosis remains in doubt.

Peak expiratory flow (PEF) should be recorded as the best of three forced expiratory blows from total lung capacity with a maximum pause of 2 seconds before blowing. The patient can be standing or sitting. Further blows should be done if the largest two PEF measurements are not within 40 L/min.

Charts are provided with peak flow meters but these are limited in duration. Drug companies provide peak flow diaries or you can use the excellent charts in the booklet FP1010, often still available from primary care organisations. Charting the readings on a graph is much preferable to recording numbers only, since it allows better pattern recognition and easier identification of maximum and minimum readings. Electronic meters with memory recording exist but are little used outside of research settings.

The age at which children become able to do reliable peak flow measurements cannot be easily defined, but most children aged 7 years and over will be able to perform meaningful peak flow measurements. Children should be given a low range peak flow meter.

If you are seeing a patient with acute wheezing that you are planning to treat with high-dose bronchodilators and/or oral corticosteroids, always measure peak flow before and after treatment; this is good practice in any case as part of the assessment of severity of the attack and may afterwards provide strong supportive evidence for an asthma diagnosis.



The brilliant Form FP1010 contains 32 weeks' worth of PEFR charts, instruction for use and care of the peak flow meter and has space at the back for a written personal action plan

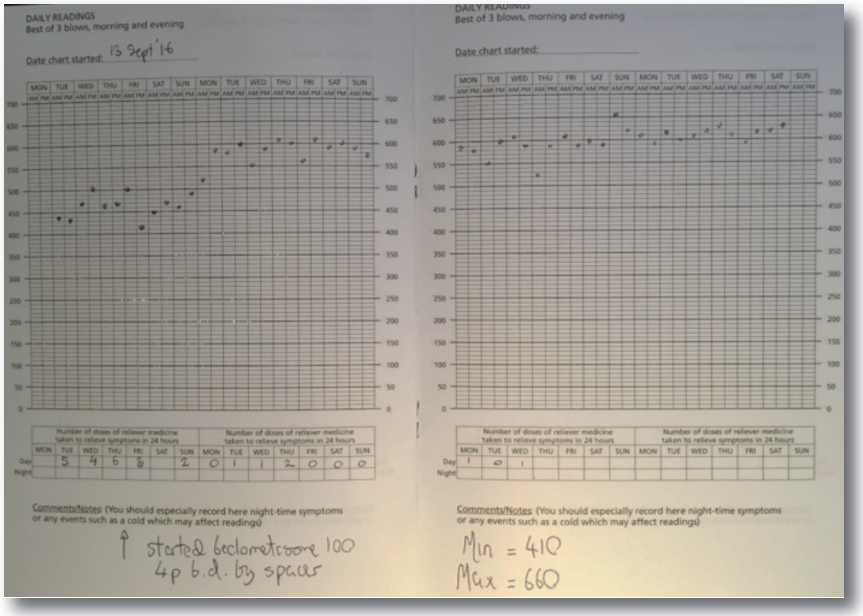
'Poor compliance'

It is often said that compliance with peak flow charting is poor. In my experience this is not true if the method, purpose and value of the charting is clearly explained and it is made clear that charting does not need to continue once the diagnosis is made. Discussions of peak flow monitoring also sometimes refer to falsification of peak flow records – usually to conceal the fact that the measurements have not actually been done. Again, what is needed is a patient and trusting relationship between health professional and parent or patient. This allows effective explanation of the importance of doing what has been asked, and of being honest if it has not been possible to do this for whatever reason. With experience it is often easy to tell that a record has been made up – and gently share this possibility with the patient. A miniscule number of patients may deliberately falsify a record to make it appear that they have asthma when they do not. This can be hard to detect but is vanishingly rare, and far more likely to be found in tertiary referral settings than in primary care.

What is abnormal peak flow variability?

There are a variety of numerical definitions. Like blood pressure and blood glucose, peak flow variability is a continuous physiological variable and cut-off points are arbitrary. One commonly used definition (cited in the BTS/SIGN guideline[2]) is the difference between maximum and minimum expressed as a percentage of the mean peak flow, with more than 20% being considered abnormal. If the max–min difference is greater than 20% of the maximum reading (easier to find than the mean), then this is clearly abnormal.

As helpful as the numbers is the appearance pattern of the graph. The most typical picture is of low readings with obvious saw tooth



Two-week peak flow tracing consistent with a diagnosis of asthma: a picture is worth a thousand words

variability flattening out and rising as symptoms respond with time or treatment.

The illustration above shows the peak flow chart of a 55-year-old never smoker with a 1-year history of recurrent worsening cough and shortness of breath. His chest X-ray was normal. His symptoms had greatly improved with a 1-week course of prednisolone but recurred when the steroids were stopped. The chart was done as he started on twice daily inhaled corticosteroids by spacer. It provides convincing objective evidence of significant peak flow variability coinciding with resolution of his symptoms. This is strongly supportive of an asthma diagnosis.

Remember occupational asthma

The possibility of occupational asthma should be borne in mind whenever you make a new asthma diagnosis in an adult. In addition to careful history taking around occupation and symptoms, a period of peak flow charting indicating when the patient is at work is vital. Patients in whom occupational asthma is suspected should be referred for specialist assessment but should chart their peak flow until seen. See http://www.occupationalasthma.com/ for more information on occupational asthma

Does peak flow monitoring have any place in the diagnosis of COPD?

Peak flow measurement is not adequate for COPD diagnosis. This requires quality-assured diagnostic spirometry in addition to a full clinical assessment. But asthma can develop at any age and, if late onset asthma (or COPD with a substantial reversible component) is suspected, then peak flow charting in addition can be valuable and provide additional useful diagnostic information.

Do patients with asthma need to continue to monitor their peak flow?

Usually not. But it is worth them keeping their peak flow meter and knowing their best and lowest readings as restarting peak flow measurements may be found useful for some people as part of a personal asthma action plan. Most patients with asthma can effectively self-manage based on symptoms alone – but some people are slow to recognise significant deteriorations ('poor symptom perceivers') and such people may find regular peak flow checking helpful.

Microspirometry

Simple inexpensive hand-held spirometers, programmed at each use with the patient's age, height and gender, can give good accurate readings of forced expiratory volume in 1 second (FEV_1) and express this as percent predicted. The patient is asked to perform a forced vital capacity type manoeuvre – as for diagnostic spirometry – but can stop after the 1 second bleep emitted by the spirometer.

It is a simple matter to obtain these measurements before and after treatment of acute symptoms, whether with high-dose bronchodilators or short course oral steroids, although both the necessary expiratory manoeuvre and the correct use of the instrument are more demanding than measurement of peak flow.

These instruments are not a substitute for full diagnostic spirometry in COPD, although they are useful for screening adults – especially symptomatic older smokers – for possible COPD. An FEV_1 of 80% predicted or less should prompt consideration of full diagnostic spirometry. 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. If asthma is

suspected, then what is needed is a microspirometry measurement at the time when the patient is symptomatic, with measurement of FEV_1 before and after treatment.

In the assessment of asthma, a rise in FEV_1 of 12% and at least 200 mL with time or treatment is suggestive of asthma. An increase of 400 mL or more in FEV_1 is strongly suggestive of asthma.[2] Here the key difference is that measurements both before and after treatment or resolution of acute symptoms provide the best information.

Conclusion

How to diagnose asthma is a matter of considerable current controversy. Significant concerns have been raised about overdiagnosis – although late diagnosis is still a problem also. The well-established BTS/SIGN guideline, updated in 2016, contains a comprehensive discussion of the approach to diagnosis and recommends spirometry as the preferred test of airways obstruction. A draft NICE guideline on diagnosis and monitoring of asthma, whose publication is currently paused, has suggested a different approach involving FeNO in addition to spirometry for (nearly) all. Both guidelines retain a place for peak flow measurements but relegate these to a subsidiary role. However, spirometry is very often normal in suspected asthma in primary care. The quality of spirometry in primary care is variable and there is a substantial training need if quality assured diagnostic spirometry is to be easily available to all[3] – a highly desirable aim. Peak flow monitoring – cheap, (relatively) simple and easily repeatable – should retain an important role in the diagnosis of asthma and all primary healthcare professionals should know how to teach and use this.

Reference

1. NICE. Asthma: diagnosis and monitoring in adults, children and young people. Draft Clinical Guideline. https://www.nice.org.uk/guidance/gid-cgwave0640/resources
2. British Thoracic Society. BTS/SIGN British guideline on the management of asthma. http://bit.ly/2cKau3U
3. Improving the quality of diagnostic spirometry in adults: the National Register of certified professionals and operators. http://bit.ly/2c6aPKQ

For further information, see centrefold wall chart for more information on diagnostic tests.