The Diagnosis of Lung Diseases; Back to basics (for the time-being)

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This Article may be cited as: Partridge MR. The Diagnosis of Lung Diseases; Back to basics (for the time-being). Pak J Chest Med 2015; 21(01): 01 - 3

The immense diversity of lung diseases shown in the accompanying figure used for undergraduate teaching, is one of the attractions of respiratory medicine for most chest physicians. However the symptoms associated with those diseases are equally diverse whether cough, shortness of breath, snoring or fever. Those diverse symptoms may equally be due to disorders of other bodily systems which means that each time we see someone complaining of shortness of breath for example we need to ask ourselves, is this patient breathless because of:

- Lung Disease
- Heart Disease
- Pulmonary Vascular disease
- Diaphragm Weakness, or a
- Systemic disorder such as anaemia, obesity or hyperthyroidism.

However even if we believe our patient to have lung disease, as we see from the figure, the next differentiation is to always consider the presence of infection or pulmonary emboli before deciding whether we are dealing with an airway disorder (in which case is the obstruction localised or generalised) or is it due to small lung disorder (in which case is the problem within the lungs or outside the lungs).

Of course the patients story plus clinical examination and if necessary, a chest radiograph often point us firmly in the direction of a suggested diagnosis but there is increasing evidence backed up by clear guidance from International guidelines that we are under using basic tests of lung function leading to problems not only with diagnosis, but equally with the accurate assessment of severity.

So what is this evidence and why don't we adopt simple technology with the same aggression that cardiologists approach heart disease and gastroenterologists approach disorders of the gastro intestinal tract?

It is a rare patient who enters a general internal medicine service without having an ECG, but how many have spirometry and is the opportunity for better diagnosis and assessment of severity overlooked? In one study published from the Johns Hopkins Hospital,[1] spirometry was performed secretly upon all patients being admitted to a medicine service whether being admitted with diabetes, liver failure or other medical problem. The notes were then perused to assess whether those who were found to have airways obstruction had that condition known by those who were caring for them. The results show that if one had very severe airways obstruction then irrespective of the conditions leading to your admission to hospital, about two thirds of those patients had their severe airways obstruction noted on admission, and nearly 90% had record of that obstruction by the time of their discharge. However if you were admitted with anything from mild to moderate to severe airway obstruction only approximately a third of those patients had any mention of that diagnosis on admission or at the time of discharge. One consequence of this was that 60% of patients with obstructive airways disease received no bronchodilators.

A further example of the impact of the use of objective diagnostic test is shown by reports from a west London, UK community respiratory assessment unit.[2] Analysis of over 1000 referrals from general practice to an open access diagnostic service showed that over 850 of the referrals were with suspected or definite asthma or COPD. If one looks only at that

those who were referred by a general practitioner with a diagnosis of definite COPD the results show that there was no evidence of airway narrowing, a cardinal feature COPD, in 16.4% of those cases. Amongst those referred with suspected COPD there was no airway narrowing present in 43% of the cases. One third of those whose diagnosis of COPD was refuted after spirometry were nevertheless already on a combination long acting beta agonist/inhaled corticosteroid inhaler and 17% were on tiotropium.

In the recently published UK national COPD audit,[3] 46% of patients within that national audit had evidence of spirometry being recorded in their hospital notes during the previous five years (the comparable figures in the 2003 and 2008 reports being 54% and 55%). Spirometry was more likely to be recorded in the notes if the patient had been seen by a member of the respiratory team (49% versus 32% (P <0.0001). The situation is likely to be similar or worse in Asthma. The May 2014 UK National review of asthma deaths report,[4] which looked in detail at those dying from asthma showed that in 33% of cases who died the basis for the diagnosis was not documented in any notes. Where it was, the diagnosis was based upon symptom pattern in 51% and in only 17% on measurement of lung function. The critical importance of the use of spirometry in the diagnosis of COPD, both for case finding and assessment of severity is clearly laid out in national and international guidelines. For asthma the objective use of spirometry has been emphasised both within the British asthma guidelines[5] but also in recent advice from the National Institute for Clinical Excellence (NICE) guidelines[6] which recommend that spirometry should be used as the first line investigation for asthma in adults and young people older than the ages of 16 (and where possible in children aged 5 to 16). They regarded a forced expiratory volume in one second/forced vital capacity ($FEV_{1.0}$/ FVC) ratio of less than 70% as a positive test for obstructive airways disease and they also outlined the importance of bronchodilator reversibility testing with an improvement in FEV1 of 12% or more together with an improvement in volume of 200mls or more as being a positive test.

The first part of the title to this editorial, the diagnosis of lung diseases; back to basics is thus a call for all respiratory physicians to recognise the absolute importance of the use of spirometry both within our clinics and on our wards and to see how we may configure a service that makes access to this simple diagnostic tool easily available to others in the community. There are published studies to show that primary care physicians are often very well aware of the need for spirometry[7] and that has also been shown amongst junior doctors,[8] although the latter are reported to lose interest in spirometry if specialists do not pay attention to the results. In providing an optimal service we also need to be aware that in some patients the brunt of lung damage is born within the air sacs rather than within the airways and recording a breathlessness score at the time of performing spirometry can also highlight those who need more

Table 1:

Airways Diseases	**Small Lung Disorders** (also known as "restrictive disorders")
Localised Obstruction	**Due to disease within the lungs**
Obstructive sleep apnoea syndrome	Idiopathic Pulmonary Fibrosis
Upper airway tumours	Sarcoidosis
Thyroid enlargement	Asbestosis
Vocal cord dysfunction	Extrinsic Allergic Alveolitis
Relapsing Polychondritis	Hypersensitivity Pneumonitis
Tumours (eg Lung Cancer)	Langerhans Cell Histiocytosis
Sub glottic and Post tracheostomy stenosis	Lymphangioleiomyomatosis
Foreign bodies	Alveolar Proteinosis
Tracheomalacia	Eosinophilic pneumonia
Generalised Obstruction	**Due to disease outside the lung**
Asthm	Pleural effusions
C.O.P.D	Mesothelioma
Bronchiectasis	Pneumothorax
Cystic Fibrosis	Scoliosis
Obliterative Bronchiolitis	Respiratory muscle weakness
Long term effects of prematurity/BPD	Obesity

Table 2:

Infections	Pulmonary Vascular Disorders
Tuberculosis Infective bronchitis Pneumonia/Empyema	Pulmonary Emboli Pulmonary Hypertension Pulmonary Arterio-venous Malformations

detailed lung function tests and CT scans.

We have thus emphasised the need to go back to basics but the title has a suffix, "… for the time being". The reason is that we are at a point in time where our approach to the diagnosis of lung disease and assessment of severity is likely to change. Measurement of lung function will always be important but in asthma we are beginning to see a greater understanding of the role of FeNo testing and there is now more clarity about what levels would constitute a diagnosis of asthma.[6] Such testing should become more easily available now that lower cost equipment is available and FeNo testing is more likely to be the way forward than sputum eosinophil counting which is not always easy to perform nor easy to repeat especially in community settings. In COPD, spirometry and breathlessness scoring are the basics but because of the problem of underestimation of severity in those who have dominant air sac disease (emphysema) rather than dominant airway disease, we need to ensure that full function testing is more easily available for the assessment of these patients and when necessary, HRCT scans. After accurate diagnosis of COPD the next priority will be in better profiling of these patients. This will involve prompter more accurate identification of infection and enhanced accuracy in determining who needs steroids. Newer risk scores such as the DECAF score emphasise the importance of eosinopenia and polymorbidity in predicting both risk of future exacerbation but also mortality.[9] There will also be increasing recognition of the fact that it is not the severity of airway obstruction that limits exercise capacity in most patients with COPD, but premature lower limb skeletal muscle fatiguability. The molecular basis for this is now clearly understood (reduced muscle oxidative capacity),[10] may soon be able to be tested for, and new treatments might become available which might provide more long term amelioration of symptoms than for example pulmonary rehabilitation.

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