Under-utilisation of spirometry leading to under-diagnosis of lung disease

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Abstract

It is recognised that chronic obstructive pulmonary disease (COPD) is under-diagnosed in the developing world. Spirometry aids the diagnosis and staging of COPD, and appears to be under-utilised.

We conducted a pilot cross-sectional study to assess the feasibility of using spirometry as a routine out-patient investigation. A prospective respiratory questionnaire was completed and spirometry was conducted. Nineteen patients underwent spirometry; three (15%) patients had GOLD stage ≥2 obstructive airway disease; two (10%) showed >12% and >200 ml reversibility in FEV1 (forced expiratory volume in 1 second), in keeping with the diagnosis of asthma; and two (10%) were referred back to the medical outpatients department for reassessment and a trial of inhalers.

We concluded that COPD is under-diagnosed in this setting. Spirometry is the gold standard for diagnosing and monitoring the progression of obstructive lung disease. Use of spirometry is feasible in this setting and successfully diagnosed new cases. Improved and continuous education about the importance of spirometry is vital.

Introduction

It is recognised that chronic obstructive pulmonary disease (COPD) is under-diagnosed in the developing world.[1,2] In addition to tobacco smoke, indoor and outdoor pollution, occupational exposure, and pulmonary infections such as tuberculosis, place populations in southern Africa at risk of developing COPD.[3–5] The World Health Organization (WHO) in 2004 estimated that 64 million people had COPD worldwide.[6] There were more than 3 million deaths from COPD and almost 90% of these occured in low- and middle-income countries.[6] WHO also estimated the prevalence of tobacco smoking to be 35.1% in males and 10.2 % in females above the age of 15 years in South Africa (2004).[7] Data from the Burden of Obstructive Lung Disease (BOLD) study estimate the prevalence of COPD, defined by the Global initiative for chronic Obstructive Lung Disease (GOLD), as stage 2 or higher, at 22.2% in males and 16.7% in females in Cape Town, South Africa.[1] Given these estimates, the importance of diagnosing COPD in order to instigate preventative, as well as pharmaceutical interventions has become a key aim of GOLD. Spirometry aids the diagnosis and staging of COPD,[8] and appears to be under-utilised.[9–11] Desalu et al, suggest that this could be due to lack of availability, lack of awareness of the range of diseases that could be investigated, or lack of skills in interpreting the results.[10]

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Mofumahadi Manapo Mopeli Hospital is a secondary care facility situated in the rural eastern Free State and provides care to an estimated population of 84 258. Unemployment is high and mining takes place locally. This hospital functions as the main referral centre for eight district level 1 hospitals, as well as multiple primary healthcare facilities. It has 72 inpatient medical beds and four intensive care beds, as well as a busy medical outpatient department. There is a trained occupational health nurse with the facilities to carry out simple spirometry. Although no pulmonologists are based here, patients can be referred to the tertiary level hospital for detailed lung function tests as well as specialist care.

From personal experience and a brief case note review of medical outpatient department (MOPD) attendance records, there appeared to be a low number of patients being diagnosed and treated for COPD. This could be due to the under-utilisation of spirometry. We conducted a pilot cross-sectional study to assess the feasibility of using spirometry as a routine outpatient investigation.

Aim of study

To assess the feasibility of using spirometry in outpatients and estimate the proportion of MOPD attendees in this setting who have abnormal spirometry results.

Materials and methods

Feasibility and pilot spirometry study

Over a 4-day period, all consenting adult patients with risk factors for COPD, attending the outpatients department completed a respiratory questionnaire, based on questions from the 1978 ATS/DLD Respiratory Symptom Questionnaire (see Appendix 1 at end of article). The majority of the population speak Sesotho, therefore an interpreter was required.

These patients then undertook basic pre- and post-bronchodilator spirometry, according to ATS standards.

A trained occupational health nurse and the investigator conducted the spirometry. The diagnosis of COPD was based on symptoms and a post bronchodilator FEV1/FVC (forced expiratory volume in 1 second/forced vital capacity) ratio <0.7 in accordance with the GOLD criteria. Any patient with abnormal spirometry was referred back to MOPD for a full assessment as part of routine clinical work.

Patients were excluded based on the following criteria:

- Signs and symptoms of active tuberculosis (TB) or pneumonia.
- Those who lacked the capacity to consent.
- Those who had been hospitalised within the last 14 days, as this could affect the interpretation of spirometry results.
- Any contraindications to spirometry.

Ethical approval was obtained from the Biomedical Research Ethics Committee of the University of the Free State.

Results

A total of 20 patients were recruited. One patient was excluded, as there were signs of active infection; 19 patients completed the questionnaire and performed spirometry. Patient demographics and risk factors are shown in Table 1.

Of these 19 patients, 3 (15%) patients had GOLD stage ≥2 obstructive airway disease. One of the three had no previous respiratory diagnosis and was not on any respiratory medications; the remaining two were previously diagnosed with asthma. Ten patients (53%) had a reduced 25–75% FEF, but normal post bronchodilator FEV1. Two (10%) showed >12% and >200 ml reversibility in FEV1, in keeping with the diagnosis of asthma. They were symptomatic and had previously been diagnosed with asthma; only one was on treatment. Two (10%) of the 19 patients were referred back to MOPD for reassessment and a trial of inhalers (see Table 2).

	Male	Female
Total number of patients (all Black African)	13	6
Average age (range) in years	59.7 (39–84)	53.3 (29–75)
Prior respiratory diagnosis:		
None	9	4
Asthma	3	2
COPD	1	0
Respiratory medications	3	1
Symptomatic	9	4
Risk factors:		
Previous TB	4	0
Smoker/ex-smoker (average pack years)	6	0
Other inhaled substances	3	2
Occupational exposure	9	2
Domestic indoor smoke exposure	2	0
Non exposure	1	3

Table 1 Patient demographics and risk factors

The questionnaire revealed that 13 patients were symptomatic with 9 complaining of two or more key symptoms (cough, sputum production, dyspnoea, and wheeze).

Figure 1 shows the relationship between those found to have abnormal spirometry and certain risk factors.

Discussion

Summary of findings

Spirometric assessment of a limited number of patients with some risk factors found abnormalities. Three (15%) patients had GOLD stage ≥2 obstructive airways disease. None of these patients was previously diagnosed with COPD. One patient, despite having risk factors and symptoms, had no previous respiratory diagnosis and therefore no treatment. The remaining two were previously diagnosed with asthma. Two (10%) had reversible spirometry consistent with the diagnosis of asthma. Only one was receiving treatment. In two cases patients were sufficiently symptomatic to benefit from a trial of inhalers and were referred back to MOPD.

The use of spirometry to diagnose COPD is essential and this is stated in the South African Guidelines for the Management of COPD.[8] This study found that it was feasible to offer spirometry as part of routine outpatient investigations. Spirometry was available in our setting but is being under utilised. Although there may be many contributing factors, we feel that a lack of awareness regarding its importance is crucial.

Suggested ways to improve this could include training junior doctors, nurses, and other healthcare professionals to perform and interpret spirometry. In addition to training, appropriate quality control and feedback is important. As is already the case with electrocardiograms being faxed for specialist cardiology opinion, spirometry results could be faxed to pulmonologists or physicians at academic centres for quality control and diagnostic interpretation. At undergraduate level simple spirometry training could be incorporated into technical skills teaching in a clinical skills laboratory. On a larger scale, raising awareness of the importance of spirometry through events such as World Spirometry Day and other awareness-raising activities would be of value.

The BOLD study demonstrated that by appropriate training and support, 10 out of 12 sites produced >90% usable spirometry results.[1] Finally we suggested having dedicated spirometry request forms in MOPD that would act as a visual aid and encourage investigations.

Strengths and weaknesses of the study

This is a small local study in a regional rural hospital and

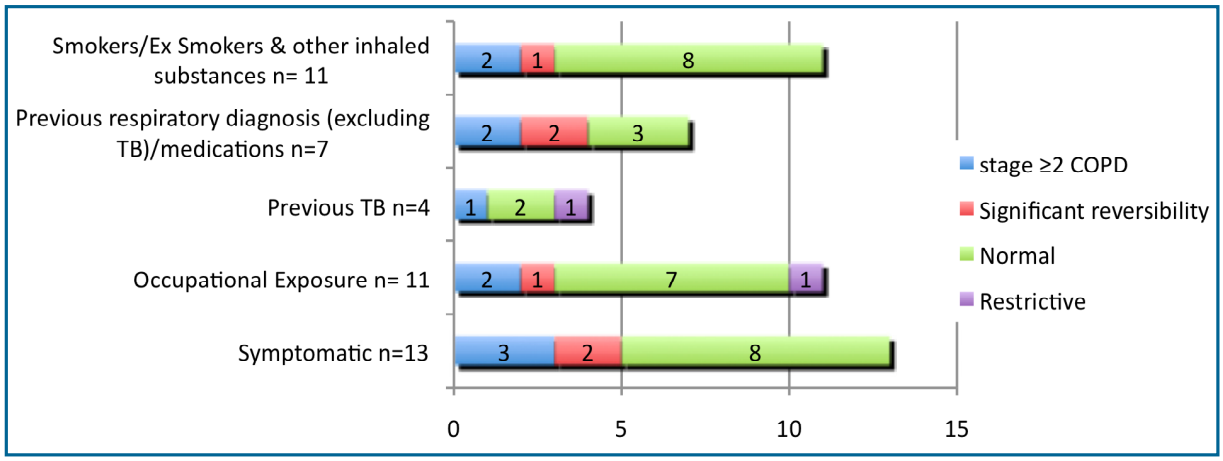

Figure 1 Abnormal spirometry versus risk factors

it is difficult to generalise the findings. The study looked at a small number of selected patients with specific risk factors over a brief period of time. It was conducted over the winter/spring months so health-seeking behaviour may impact the attendance rates.

This is the first study of this kind done at this hospital and also in this area. It engaged the local doctors and other medical staff. The equipment and staff were already present so there were limited costs. Interviews were conducted with the aid of a translator to keep communication error to a minimum. Spirometry readings were the best of three attempts to reduce any measurement error. The same personnel with appropriate training conducted spirometry according to the American Thoracic Society (ATS) protocol to minimise operator error.

Comparison of results with other studies

There is limited spirometric data on the burden of chronic airways disease in this area in published literature. The BOLD Study collected data from the Cape Town province of South Africa. Similar prevalence studies have not been conducted in the other provinces of South Africa. The risk factor profiles between the different provinces are different and therefore epidemiological studies also need to be conducted in the other parts of South Africa.

Mehrotra et al, found a lack of availability and under utilisation of spirometry in Africa in general.[9] In South Africa all diagnoses were based on spirometry, which could be due to the fact that they contacted members of the Pan African Thoracic Society, based at larger tertiary academic specialist centres where pulmonologists routinely use spirometry. This was not the case in our rural setting. There were no pulmonologists based at our hospital, highlighting the possible discrepancy of healthcare resources between the rural and urban areas in South Africa.

This limited study highlights the importance of conducting more prevalence studies, especially in remote areas to better estimate the burden of chronic lung disease.

Conclusion

COPD is under-diagnosed in this setting. Spirometry is the gold standard for diagnosing and monitoring the progression of obstructive lung disease. The use of spirometry in outpatients in this setting is feasible and it successfully diagnosed new cases that otherwise would have not been diagnosed. Improved and continuous education about the importance of spirometry is key.

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Appendix 1 over page.

1. **Age:**
2. **Gender:**
3. **Race:**
4. **Height:**
5. **Weight:**
6. **Area:**
7. **Income:**
8. **Do you have any respiratory problems?**
   Bronchitis/Pneumonia/TB/Emphysema/Asthma
9. **Have you ever had TB?**
10. **Do you have any of the following symptoms?**
    (a) Cough?
    Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?
    Do you usually cough at all on getting up, or first thing in the morning?
    Do you usually cough at all during the rest of the day or at night?
    (b) Haemoptysis?
    (c) Sputum production?
    • Do you usually bring up phlegm like this as much as twice a day, 4 or more days out of the week?
    • Do you bring up phlegm like this on most days for 3 consecutive months or more during the year?
    • How many years have you had trouble with phlegm?
    • Sputum volume?
    • Sputum purulence?
    (d) Shortness of breath (MRC grade 1–5)?
    (e) Wheeze?
    (f) Fever?
    (g) Weight loss?
    (h) Night sweats?

    If yes to any of the above, how long and how frequently does it occur?
11. **What medications do you take?**
12. **Do you smoke tobacco?**
    If yes start age, stop age, pack years?
13. **Do you smoke any thing else?**
    Substance? Amount? Duration?
14. **What is your occupation?**
    (a) Current industry?
    (b) Have you ever worked full time (30 hours per week or more) for 6 months or more?
    (c) Have you ever worked for a year or more in any dusty job/gas/chemicals?
15. **Cooking methods?**
    Past and present? Type of fuel used?
16. **Family history of lung disease?**

Measurements

FEV1: pre- post-
FVC: pre- post-

Appendix 1 Questionnaire

Guidance for authors

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Tables should be clearly identified.

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