

## THE PREDICTIVE VALUE OF PROVISIONAL CLINICAL DIAGNOSIS IN THE EVALUATION OF RESPIRATORY DISORDERS

Khadadah E. Mousa, MRCP; Mustafa T. Hani, SCM, KIMS; T.N. Sugathan, PhD;  
Telahoun Girma, MIST; B.O. Onadeko, MD, FRCP

**Background:** Many non-pulmonary physicians in hospital and family care practice base the diagnosis of pulmonary disorders on clinical impressions made from the history and physical examination. Experience has shown that relying on these parameters alone is not adequate, since this may result in missing a significant number of diseases, or in the unnecessary treatment of others. This study set out to compare the sensitivity, specificity and positive predictive value of the clinical assessment (provisional clinical diagnosis or PCD) with the combined clinical assessment and other investigations, including pulmonary function test (PFT).

**Patients and Methods:** One thousand and fifteen (1015) patients referred for PFT to the pulmonary function laboratory of a teaching hospital were involved in the study. The referring physicians were asked to fill a specially prepared form giving details of the patients' history and clinical assessment. The PFT was performed using an Erich-Jager Master Lab.

**Results:** Analysis of the final diagnosis revealed that only 51% of patients with a pre-evaluation diagnosis of asthma were actually confirmed to have asthma after further tests. Similar findings of 59% and 52% of patients with chronic obstructive pulmonary disease (COPD) and pulmonary fibrosis were observed, respectively. The positive predictive value of PCD for asthma and lung fibrosis was 64.1% and 61.9%, respectively, while that for COPD was 74.2%.

**Conclusion:** This study showed conclusively that the predictive value of provisional clinical diagnosis in the evaluation of pulmonary disorders is usually inadequate, and needs to be augmented with additional simple investigations such as PFT, in order to establish a more accurate diagnosis.

*Ann Saudi Med 1999;19(2):93-96.*

**Key Words:** Respiratory disorders, sensitivity, specificity, pulmonary function tests.

The pulmonary function test (PFT) is widely used in the diagnosis and monitoring of lung diseases.<sup>1-6</sup> The diagnosis of lung diseases cannot be reliably made from perceptions formed from history-taking and physical examination.<sup>7-11</sup> The National Asthma Education Program, in its asthma therapy guidelines, recommends that spirometry be conducted in the initial assessment of all patients being evaluated for asthma.<sup>12</sup> Similarly, the importance of spirometry in the identification and management of chronic obstructive pulmonary disease (COPD) has been emphasized.<sup>13</sup> Crapo<sup>1</sup> highlighted the role of spirometry in the evaluation of abnormal symptoms, such as cough, dyspnea, wheezing or chest pain.

It was observed in our teaching hospital that less than

10% of physicians in the general medicine outpatient department, and even fewer in the primary care practice, use the peak flow meter for the assessment and follow-up of asthma patients, and almost none use it for COPD patients. Most of these physicians treat patients on a presumptive diagnosis based on clinical judgement only. Subsequent evaluation, using the PFT and other investigative procedures, has revealed that the original diagnosis was incorrect in a significant proportion of these patients. The availability of at least a spirometer in most of the health centers makes it obligatory that patients with pulmonary disorders or unexplained respiratory symptoms be properly assessed before treatment is embarked upon. However, not all medical personnel use this test as required.

This study was designed to compare the physician's clinical assessment of patients presenting with pulmonary symptoms with that of other clinical assessments made in addition to PFT and other ancillary tests in reaching a final definitive diagnosis. The aim was to determine the sensitivity and specificity of the physician's assessment and compare it with the combined clinical and other assessments, including a PFT.

---

From the Departments of Medicine (Drs. Mousa and Onadeko), Community Medicine (Dr. Sugathan), and Physiology (Dr. Girma), Faculty of Medicine, Kuwait University, and from the Department of Medicine (Dr. Hani), Mubarak Hospital, Kuwait.

Address reprint requests and correspondence to Dr. Mousa: Department of Medicine, Faculty of Medicine, Kuwait University, P.O. Box 24923, Safat 13110, Kuwait.

Accepted for publication 21 November 1998. Received 31 May 1998.

TABLE 1. Analysis of pulmonary disorders: Provisional and definitive diagnosis after investigations.

Provisional diagnosis	# (%)	Definitive diagnosis # (%)					
		Normal	Asthma	COPD	Pulm. fibrosis	Other	Mixed
Normal	14 (2)	13 (92.9)	1 (7.1)	-	-	-	-
Asthma	192 (27.4)	55 (28.6)	98 (51)	37 (19.3)	2 (1.0)	-	-
COPD	39 (5.6)	8 (20.5)	7 (17.9)	23 (59)	-	1 (2.6)	-
Pulm.* fibrosis	25 (3.3)	8 (34.8)	0	2 (8.7)	13 (52.2)	-	2 (4.3)
Pre-operative**	87 (12.4)	45 (51.7)	14 (16.1)	14 (16.1)	14 (16.1)	-	-
Cough	169 (24.1)	93 (55.0)	39 (23.1)	26 (15.4)	8 (4.7)	2 (1.2)	1 (0.6)
Dyspnea	173 (24.7)	97 (56.1)	32 (18.5)	27 (15.6)	16 (9.2)	1 (0.6)	-
Lymph-angitis	1 (0.1)	-	1	-	-	-	-
Total	700 (100)	319	192	129	53	4	3

COPD=chronic obstructive pulmonary disease; \*pulmonary fibrosis; \*\*pre-operative evaluation.

TABLE 2. Sensitivity, specificity and diagnostic accuracy of the provisional clinical diagnosis made by the physician.

Provisional diagnosis	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Diagnostic accuracy (%)
Asthma	51.0	82.8	64.1	70.8
COPD	17.8	97.5	74.2	74.5
Fibrosis	24.5	97.5	61.9	87.1

### Patients and Methods

This study was carried out in the Chest Unit of the Kuwait University Teaching Hospital with the approval of the Hospital Ethical Committee. All patients gave an informed consent. All new patients who were referred for pulmonary function test from January to December 1995 were initially recruited to the study. The referring physician filled in a specially prepared form containing personal information such as age, sex, height, weight, smoking history, presenting symptoms and signs, and the physician's presumed or provisional diagnosis.

The pulmonary function test (PFT) was performed by a single technician (to reduce the inter-test error), using the Erich-Jager Master Lab, and complying with the American Thoracic Society (ATS) guidelines published in 1995.<sup>14</sup> The PFT included spirometric parameters such as the forced expiratory volume in the first second (FEV<sub>1</sub>), forced vital capacity (FVC), the ratio of FEV<sub>1</sub>/FVC%, peak expiratory flow (PEF) and the mid flow rate (FEF 25%-75%); volumes, such as total lung capacity (TLC), residual volume (RV), and functional residual capacity (FRC); and

diffusion capacity (single breath test). Two physicians interpreted the reports independently in compliance with the ATS criteria.<sup>3</sup> Reversibility was defined as more than 15% improvement in FEV<sub>1</sub> after bronchodilatation.

Asthma was diagnosed by a combination of history of intermittent dyspnea, especially at night with or without cough, signs of wheezing and an FEV<sub>1</sub> of less than 80% predicted, with improvement of 15% or more after bronchodilatation. In undetermined cases, where neither asthma nor COPD diagnosis was made, bronchial provocation test using methacholine was used and the PD20 FEV<sub>1</sub> was estimated. The method used was that of Yan et al.<sup>15</sup>

A diagnosis of COPD was made from history, symptoms, signs, evidence of airflow obstruction with no improvement after bronchodilator (or reversibility of less than 10%), increased lung volumes and reduced diffusion. This was supplemented by a chest radiograph, electrocardiograph and arterial blood gases when indicated.

Pulmonary fibrosis was diagnosed by a combination of clinical features, restrictive lung pattern on PFT and reduced diffusion capacity. Further confirmatory tests, such as high-resolution computed tomography and lung (bronchoscopic or open) biopsy were done when indicated. Only patients who completed the above-mentioned tests were included in the final analysis. Sensitivity, specificity and predictive value of the provisional clinical diagnosis were calculated with reference to the final diagnosis, using Bayes' theorem.<sup>16</sup>

### Results

A total of 1015 patients were admitted into the study. The results of 700 patients who satisfactorily completed the pulmonary function studies together with other relevant investigations were accepted for analysis. Other patients were excluded because of several factors, including non-cooperation during the period of the study, inability to perform the pulmonary function test properly, and non-completion of one or more of the necessary investigations included in the study. Table 1 shows the distribution of provisional clinical diagnosis compared with the final definitive diagnosis.

The preoperative cases were those patients with undefined respiratory disease, but who were referred for evaluation prior to undergoing major surgery. Of the 87 cases, 45 (51.7%) were found to be normal. Fourteen cases (16%) were diagnosed as asthma, 14 (16%) as having COPD, and another 14 (16%) as having pulmonary fibrosis. Only 51% of patients with a provisional diagnosis of asthma were actually confirmed to have asthma. Nineteen percent had COPD, while 1% had pulmonary fibrosis.

After comprehensive investigations of the 39 patients who had a provisional diagnosis of COPD, only 23 cases

(59%) were confirmed as having COPD, while seven cases (18%) had asthma. Twenty-five cases had a pre-evaluation diagnosis of pulmonary fibrosis, but only 13 cases (52%) had fibrosis confirmed after investigation, while two cases (8.7%) had COPD, and eight cases (34%) had no respiratory disease.

Unexplained cough and dyspnea are two symptoms for which patients were referred frequently to the Chest Unit for further investigations. Out of the 169 patients with unexplained cough, 73 cases (55%) were found to have no significant pulmonary cause for their symptoms. Thirty-nine cases (23%) had asthma, while 26 (15%) and eight cases (4.7%) had COPD and pulmonary fibrosis, respectively. Similarly, 173 patients were investigated for unexplained dyspnea. No significant pulmonary cause was found in 97 cases (56%). Thirty-two cases (18.5%) were diagnosed as asthma. Of these, 27 (15.6%) turned out to be COPD, while 16 cases (9.2%) had fibrotic lung disease.

Table 2 gives the results of validation of the provisional clinical diagnosis (PCD), showing sensitivity, specificity and positive predictive value. The sensitivity of PCD for asthma is only 51%, and much lower for COPD and pulmonary fibrosis, being 17.8% and 24.5%, respectively. The predictive values were found to be 64.1% and 61.9% for both asthma and fibrotic lung disease, respectively, and 74.2% for COPD.

### Discussion

The findings in this study reaffirm the necessity of incorporating the PFT in the routine investigation of patients with pulmonary disorders or unexplained respiratory symptoms. In their studies, Hepper et al.<sup>7</sup> and Russel et al.<sup>8</sup> have shown the significance of pulmonary function testing in the management of patients with pulmonary disease. However, in our study, it is of interest to observe that only 98 of 192 cases (51%) in which a provisional clinical diagnosis of asthma was made before had the diagnosis confirmed using the PFT and other parameters. The sensitivity of the PCD of asthma was also found to be low (51%). This reflects the underdiagnosis of cases of asthma in the community. This is not to say that physicians (primary care or hospital-based) are not aware of the diagnosis or do not suspect it. On the contrary, with increased emphasis being placed locally and globally on such a fatal but easily diagnosed and treated disease, physicians are actually over-diagnosing the disease. This is evident from the fact that the positive predictive value is also low (64.1%), which means that too many false-positive cases are present. Adequate and careful investigations including PFT will significantly increase the predictive value of the disease.

The overall findings of this study revealed that the number of cases with a provisional diagnosis of asthma is coincidentally the same as the number in the definitive diagnosis. Some of the cases diagnosed as asthma from the

group with unexplained cough, dyspnea and preoperative conditions make up the number in the definitive diagnosis. A significant proportion of patients who presented with unexplained cough or dyspnea in this study had either asthma or COPD. When these symptoms were combined with PFT and other investigations, a definitive diagnosis of a pulmonary disease was made in about 50% of the cases. A similar observation has been made in other studies.<sup>17-19</sup> Thirty-seven cases (19.3%) suspected as asthma turned out to be COPD. This finding emphasizes the need for thorough investigation of patients presenting as asthma before therapy is commenced.

The sensitivity of clinical diagnosis in this study was lower in COPD and pulmonary fibrosis, being 17.8% and 24.5%, respectively, than in asthma, which was 51%. A good test should have both the qualities of high sensitivity and high-positive predictive value in order to reduce false-positive and false-negative cases.

The observations made in this study show that the predictive value of provisional clinical diagnosis in the evaluation of pulmonary disorders is usually inadequate, and needs to be combined with other tests. In addition to a comprehensive history, physicians should conduct more relevant investigations, including pulmonary function test, in making the diagnosis. These tests are readily available and affordable, and can also be done in a relatively short time. It is unacceptable to diagnose and treat pulmonary disorders, especially asthma, without pulmonary function testing, just as it would be unacceptable to diagnose and treat hypertension without measuring the blood pressure, or to diagnose and treat diabetes mellitus without checking the blood sugar.

### References

1. Crapo RO. Pulmonary function testing. *New Engl J Med* 1994;331:25-30.
2. Enright PL, Johnson LR, Connett JE. Spirometry in the lung health study: methods and quality control. *Am Rev Respir Dis* 1991; 143:1215-23.
3. American Thoracic Society. Lung function testing: selection of reference values and interpretation strategies. *Am Rev Respir Dis* 1991;144:1202-18.
4. Smith HR, Irvin CG, Cherniack RM. The utility of spirometry in the diagnosis of reversible airway obstruction. *Chest* 1992;101:1577-81.
5. Hewson PH, Tippet EA, Jones DM, Maddern JP, Higgs P. Routine pulmonary function test in young adolescents with asthma in general practice. *Med J Aust* 1996;165:469-72.
6. Bye MR, Kerstein D, Barsh E. The importance of spirometry in assessment of childhood asthma. *Am J Dis Child* 1992;146:977-81.
7. Hepper NG, Hyatt RE, Fowler WS. Detection of chronic obstructive lung disease: an evaluation of the medical history and physical examination. *Arch Environ Health* 1989;19:806.
8. Russel NJ, Crichton NJ, Emerson PA, Morgan AD. Quantitative assessment of the value of spirometry. *Thorax* 1986;41:360.
9. Gentry SE, Hodge RH, Kaiser D, Walker FB, Suratt PM. Pulmonary function testing in a general medical practice. *Common Health* 1983;8:263.
10. Emmerman CL, Lukens TW, Effron D. Physician estimation of FEV<sub>1</sub> in acute exacerbation of COPD. *Chest* 1994;105:1709.
11. Kryger M, Bode F, Antic R, Anthonisen N. Diagnosis of obstruction of upper and central airways. *Am J Med* 1976;61:85.

12. US Department of Health and Human Services. National Asthma Education Program: Executive Summary: guidelines for the diagnosis and management of asthma. June 1991, Publication No. 91-3042A.
13. Ferguson GT, Cherniack RM. Management of chronic obstructive pulmonary disease. *N Engl J Med* 1993;328:1017.
14. Standardization of Spirometry 1994 Update. American Thoracic Society. *Am J Respir Crit Care Med* 1995;152:1107-36.
15. Yan K, Salome C, Woolcock AJ. Rapid method for measurement of bronchial responsiveness. *Thorax* 1983;38:760-5.
16. WHO Regional Office for the Western Pacific, Manila. Health Research Methodology. A guide for training in research methods. Manila: World Health Organization, 1992:110-20.
18. London LI. The value of lung function in guiding drug therapy in childhood asthma. *Eur Resp Rev* 1994;4:10-4.
19. Ramsdell JW, Tisi GM. Determination of bronchodilatation in the clinical pulmonary function laboratory: role of changes in static lung volumes. *Chest* 1979;76:622-8.
20. Ries AL, Clansen JL. Response to bronchodialators in pulmonary function testing: guidelines and controversies. San Diego: Academy Press, 1982:215-21.