

A prospective audit of referrals for breathlessness in patients hospitalised for other reasons

A Mukhopadhyay, T K Lim

ABSTRACT

Introduction: This prospective audit examines the diagnostic and clinical outcomes of consecutive adult inpatients who were admitted to a university hospital for other reasons and referred for breathlessness to respiratory physicians.

Methods: We enrolled all adult inpatients referred for breathlessness from May 2000 to October 2001. We evaluated the clinical features and utility of routine investigations, such as blood tests and radiology. Subsequent investigations were undertaken at the discretion of the physician.

Results: Of the 105 patients, 49 were men and 56 were women. Their mean age was 66 ± 18 years. Surgical departments and cardiology were the main referring departments. Respiratory infection (31 percent) was the most common diagnosis. Acute pulmonary embolism (PE) was diagnosed in four patients postoperatively. Chest radiographs were helpful in making a diagnosis in 66 percent of patients. Computed tomography pulmonary angiogram of the thorax was performed in 31 of the 34 patients who were investigated for acute PE. More postoperative than non-postoperative patients were tested for PE (p-value less than 0.0001).

Conclusion: In hospitalised patients referred for breathlessness, respiratory infections were the most common diagnosis and the chest radiograph was the most useful initial investigation. Computed tomography pulmonary angiogram was the preferred investigation for acute PE and clinicians were more inclined to investigate for PE in postoperative patients.

Keywords: chest radiograph, computed tomography pulmonary angiogram, dyspnoea, pulmonary embolism

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INTRODUCTION

Breathlessness is a common symptom in the community⁽¹⁾ and an important reason for hospital

admission^(2,3). Previous studies of breathlessness have involved patients who presented to general medical clinics⁽⁴⁾ or emergency medical departments⁽⁵⁾ with breathlessness. These studies were mainly directed at identifying the relative frequencies of the different underlying causes of dyspnoea. To our knowledge, patients who were admitted to the hospital for other problems and who developed breathlessness subsequently have not been studied in the past.

Newer diagnostic tests have emerged in recent years that may play an important role in the management of patients with breathlessness⁽⁶⁻⁸⁾. The most promising of these are non-invasive tests used in the diagnosis of acute pulmonary embolism (PE). There is little information, however, regarding the clinical utility and impact of these newer investigations in the routine management of patients who develop dyspnoea in hospital. In this study, we prospectively evaluated consecutive adult inpatients referred to respiratory physicians for breathlessness in the hospital setting in order to determine the patterns of referral, management strategies and clinical outcomes.

METHODS

We enrolled consecutive adult inpatients referred for breathlessness to a group of six respiratory physicians from May 2000 to October 2001. Patients were admitted to different specialties according to the primary diagnosis made at the Accident and Emergency department by the emergency physician. Since this was an audit primarily of referrals for breathlessness, patients admitted under respiratory medicine were not included. Patients who had breathlessness as the primary reason for admission were also not included in the study. However, patients who had a previous lung condition, which is not the current problem, were included.

All patients had routine blood tests, chest radiographs, electrocardiograms and arterial blood gas measurement or pulse oximetry. We did not follow a routine protocol for investigation due to the multiple factors that may contribute to breathlessness.

Department of
Medicine
National University
Hospital
5 Lower Kent
Ridge Road
Singapore 119074

A Mukhopadhyay,
MBBS, MD, MRCP
Associate Consultant

T K Lim, MBBS,
MMed, FRCP
Senior Consultant
and Head,
Respiratory Medicine

Correspondence to:
Dr Lim Tow Keang
Tel: (65) 6779 5555
Fax: (65) 6779 4112
Email: mdclimtk@
nus.edu.sg

Subsequent investigations were decided, depending on clinical examination and the result for the baseline tests. These may include ventilation-perfusion (VQ) scan, Doppler ultrasonographical study of leg veins, spiral computed tomography (CT), echocardiography, bronchoscopy and lung biopsies (transbronchial and open lung). Inter-observer disagreements were resolved by consensus or consultation with a third specialist.

Results of investigation and their clinical outcomes were entered prospectively in a standard proforma. Patients were categorised as postoperative when dyspnoea occurred within two weeks of surgery. They were reviewed periodically until they were either discharged or died. We considered an initial investigation to be useful if it yielded positive information, which is helpful in the final diagnosis, or negative information to exclude a differential diagnosis. A respiratory infection was diagnosed by clinical signs and symptoms (cough, fever, productive sputum, dyspnoea, chest pain or abnormal breath sounds) and radiographic pulmonary abnormalities suggestive of consolidation or bronchopneumonic infiltration. We diagnosed asthma and chronic obstructive airway disease clinically, taking into consideration the patient's history, smoking habits, treatment records and response to therapy. A diagnosis of congestive cardiac failure was also undertaken, mostly on a clinical basis, after considering presenting features, radiology and risk factors such as diabetes mellitus and previous heart failure.

Data were analysed using statistical package for Statistical Package for Social Science version 11.0, (Chicago, IL, USA). Summary data was expressed as mean \pm standard deviation and chi-square tests were used for comparison of ratios between groups. A value of $p < 0.05$ was considered to be statistically significant.

RESULTS

There were 105 patients with a mean age of 66 ± 18 years (range, 17 to 94 years). Of these, 49 patients were men and 56 were women. The mean duration between admissions and referral dates was 8.4 ± 9.3 days. General surgery (19%) was the main referring department. Others include orthopaedic surgery (17%), cardiology (17%), obstetrics and gynaecology (7%), and other specialties (38%). Chest radiographs were the most useful investigation in the initial assessment of the patients. They revealed some information regarding the diagnosis in a majority (66%) of the patients.

Respiratory infection (31.4%) was the most common diagnosis and this was followed by obstructive airway diseases (21%), which include chronic obstructive airway disease and asthma. Other diagnoses include

Table I. Main diagnostic categories.

Diagnosis	No (%)
Respiratory infection	33 (31.4%)
Obstructive airway disease	22 (21%)
Congestive cardiac failure	13 (12.4%)
Combined problems	11 (10.5%)
Pulmonary embolism	4 (3.8%)

congestive cardiac failure (12.4%), other respiratory disorders (7.6%), such as pleural effusions, obstructive sleep apnoea and interstitial lung disease, and non-respiratory disorders (13.3%), such as metabolic acidosis from different causes and hyperventilation. PE was diagnosed in four (3.8%) subjects, all of whom were postoperative patients.

Eleven (10.5%) patients had a combination of factors contributing to dyspnoea; four had obstructive airway disease and congestive cardiac failure, four had obstructive airway disease and pulmonary infection, one had obstructive airway disease and pleural effusion, another had post-operative atelectasis and congestive cardiac failure, and the last patient had respiratory infection and congestive cardiac failure. The distribution of the main diagnostic categories is shown in Table I.

A total of 34 (32%) patients had undergone a single or a combination of tests to exclude acute PE. Of these, the majority (86%) had CT pulmonary angiogram examination. Only two patients had VQ scan and another patient had both VQ scan and Doppler ultrasonography of the leg veins. Apart from confirming the diagnosis of PE in three cases, CT of the thorax was helpful in the diagnosis of other diseases in 61% of patients tested (Table II). One patient was diagnosed to have acute PE by VQ scan. PE was investigated in 64% of 25 postoperative patients compared with 22.5% of the other patients who were not operated in the recent fortnight ($p < 0.0001$). Twenty-one (20%) patients died. A review of the death certificates showed that 15 (71%) patients died from diseases other than those, which resulted in the breathlessness.

DISCUSSION

The prevalence of shortness of breath is variable and depends primarily on the clinical setting in which patients have been investigated. It has been reported to be 3%-25% in the general community⁽¹⁾, 3.7% in a general medical clinic⁽⁴⁾, 2.7% in an emergency department⁽⁵⁾ and constitutes 15%-25% of all hospital admissions^(2,3). The risk factors for dyspnoea include old age, smoking, morbid obesity and female gender⁽³⁾.

In an analysis of 455 elderly patients attending an emergency department, Lim and Yap⁽⁹⁾ showed that abnormalities of breathing was a common presenting symptom and was also the most common cause of hospital admission.

In this study, the main cause of dyspnoea was respiratory infections in 31.4% of patients. In contrast, both Fedullo et al⁽⁵⁾ and Schmitt et al⁽²⁾ reported airway obstruction as the most common problem. This was diagnosed in 40% and 42% of their patients with dyspnoea, respectively. Both studies were conducted in patients in emergency departments. Our patients were referred to respiratory physicians after they had been admitted to hospital for other problems and had thereafter developed shortness of breath. The different clinical setting could have accounted for the variation in the incidence of aetiological conditions observed in this study, compared with previous reports.

Patients who presented with airway obstruction were admitted directly to the respiratory ward and were not subjected to referrals. The percentage of patients in the studies of Fedullo et al⁽⁵⁾ and Schmitt et al⁽²⁾ who had heart failure were 25.9 and 31%, respectively. In our study, only 18% of patients had heart failure. It is likely that most patients with frank heart failure were admitted to the cardiology department and were not referred to the respiratory physicians.

Acute PE is a major consideration in patients who develop unexplained breathlessness while in hospital. However, PE appeared to be uncommon and was diagnosed in only 3.8% of our patients. In a study of 177 patients admitted to hospital with breathlessness, Pearson et al⁽¹⁰⁾ reported PE in 7%. All our patients with PE developed dyspnoea and were investigated during the postoperative period. As post-surgical patients were more likely to be investigated for acute PE than non-surgical patients, the real incidence of PE is not known and needs further study.

Most evidence-based guidelines on the approach to patients suspected of acute PE, including that published by the American Thoracic Society⁽¹¹⁾, recommend VQ scanning as the first screening test. In our study, the CT pulmonary angiogram was the investigation of choice for suspected acute PE. Lung scanning was performed in less than 10% of these patients. Radionuclide lung scanning has been extensively validated and is considered a pivotal test in the diagnosis of acute PE. However, only a minority of patients with suspected acute PE has a definitive diagnosis following VQ scanning. Many patients return intermediate-probability scans for PE and these usually require more tests.

Table II: CT pulmonary angiogram findings.

CT thorax			%
Airspace diseases	Consolidation	7	29
	Abscess	1	
	Interstitial fibrosis	1	
Pleural diseases	Pleural effusion	2	10
	Pneumothorax	1	
Pulmonary embolism		3	10
Other pulmonary diseases	Anterior mediastinal mass	1	6
	Bronchiectasis	1	
Extrapulmonary diseases	Liver abscess	1	6
	Hamartoma in liver	1	
Normal		12	39
Total		31	100

In the Prospective Investigation of Pulmonary Embolism Diagnosis trial⁽¹²⁾ the incidence of intermediate-probability scans was 13%, even in patients with normal chest radiographs; this increased to 43% in patients with of cardiopulmonary disease. As parenchymal lung abnormality increases, it is likely that the scan will be non-diagnostic. The British Thoracic Society guidelines for the diagnosis of PE⁽¹³⁾ acknowledge the advantages of the CT pulmonary angiogram and recommend this as the first test for clinically-suspected submassive and massive PE. Since lung scans are likely to be non-diagnostic in patients with pre-existing cardiorespiratory illness, this explained its infrequent use in our study.

Breathlessness is a non-specific symptom associated with several cardio-respiratory disorders. Hence, the advantage of employing a polyvalent test like spiral CT is evident. While VQ scans can help to diagnose PE, CT of the thorax provides additional information on why the patient is unwell. In our study, 39% of patients evaluated had a normal CT of the thorax, 10% had acute PE and 51% had other abnormalities (Table II). Coche et al⁽¹⁴⁾ analysed spiral CT scans of 88 patients with suspected PE and found that 37.5% had wedge-shaped consolidations and 28.4% had linear band of atelectasis. In their retrospective analysis of 92 patients with suspected PE, Shah et al⁽¹⁵⁾ found that parenchymal abnormalities were common (90%), with atelectasis being the most prevalent. Given the ease of performing this examination in an acutely-ill patient and the array of useful information it reveals, it is not surprising that clinicians are more inclined to request for spiral CT of the thorax compared to VQ scans. However, the test involves

the administration of a large dose of contrast material, which may not be suitable in patients with impaired renal function.

This study has several limitations. Firstly, the diagnosis of asthma and chronic obstructive pulmonary disease was based on clinical information and not pulmonary function test. For practical reasons, pulmonary function tests could not be performed in all patients, such as postoperative cases. Similarly, the diagnosis of congestive heart failure was made on clinical grounds and not all patients had undergone echocardiographical examination. Secondly, a preoperative assessment was not included in most postoperative patients. This was because several of the patients had emergency operation and was not suitable for preoperative assessment. As only one-third of our patients were investigated for PE, the actual incidence of acute PE in patients who develop acute breathlessness in the hospital may be greater than 3.8%. Lastly, death certification of cause of death is known to be inaccurate and no conclusion can be drawn whether the diagnosis causing breathlessness actually contributed to patient's death depending on the certification.

To our knowledge, this is the first study of inpatient referrals for dyspnoea. We conclude that respiratory infections are the most common diagnosis, the chest radiograph is the most useful initial investigation, and the CT pulmonary angiogram is the preferred investigation to diagnose pulmonary embolism. All patients with PE were postoperative in this study. However, physicians were more inclined to perform investigations to exclude PE in postoperative patients.

REFERENCES

- Mulrow CD, Lucey CR, Farnett LE. Discriminating causes of dyspnea through clinical examination. *J Gen Intern Med* 1993; 8:383-92.
- Schmitt BP, Kushner MS, Wiener SL. The diagnostic usefulness of the history of the patient with dyspnea. *J Gen Intern Med* 1986; 1:386-93.
- Mustchin CP, Tiwari I. Diagnosing the breathless patient. *Lancet* 1982; 1:907-8.
- Kroenke K, Mangelsdorff AD. Common symptoms in ambulatory care: incidence, evaluation, therapy, and outcome. *Am J Med* 1989; 86:262-6.
- Fedullo AJ, Swinburne AJ, McGuire-Dunn C. Complaints of breathlessness in the emergency department. The experience at a community hospital. *NY State J Med* 1986; 86:4-6.
- Lorut C, Ghossains M, Horellou MH, Achkar A, Fretault J, Laaban JP. A noninvasive diagnostic strategy including spiral computed tomography in patients with suspected pulmonary embolism. *Am J Respir Crit Care Med* 2000; 162:1413-8.
- Maisel AS, Krishnaswamy P, Nowak RM, McCord J, Hollander JE, Duc P, et al. Rapid measurement of B-type natriuretic peptide in the emergency diagnosis of heart failure. *N Engl J Med* 2002; 347:161-7.
- Burkill GJ, Bell JR, Chinn RJ, Healy JC, Costello C, Acton L, et al. The use of a D-dimer assay in patients undergoing CT pulmonary angiography for suspected pulmonary embolus. *Clin Radiol* 2002; 57:41-6.
- Lim KH, Yap KB. The presentation of elderly people at an emergency department in Singapore. *Singapore Med J* 1999; 40:742-4.
- Pearson SB, Pearson EM, Mitchell JR. The diagnosis and management of patients admitted to hospital with acute breathlessness. *Postgrad Med J* 1981; 57:419-24.
- Tapson VF, Carroll BA, Davidson BL, Elliott CG, Fedullo PF, Hales CA, et al. The diagnostic approach to acute venous thromboembolism. Clinical practice guideline. American Thoracic Society. *Am J Respir Crit Care Med* 1999; 160:1043-66.
- Value of the ventilation/perfusion scan in acute pulmonary embolism. Results of the prospective investigation of pulmonary embolism diagnosis (PIOPED). The PIOPED Investigators. *JAMA* 1990; 263:2753-9.
- British Thoracic Society guidelines for the management of suspected acute pulmonary embolism. *Thorax* 2003; 58:470-83.
- Coche EE, Muller NL, Kim KI, Wiggs BR, Mayo JR. Acute pulmonary embolism: ancillary findings at spiral CT. *Radiology* 1998; 207:753-8.
- Shah AA, Davis SD, Gamsu G, Intriere L. Parenchymal and pleural findings in patients with and patients without acute pulmonary embolism detected at spiral CT. *Radiology* 1999; 211:147-53.