PULMONARY DISEASE

in the Adult

Douglas R. Gracey, editor

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PULMONARY DISEASE in the ADULT

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Preface

Although there are several excellent texts dealing with pulmonary disease, most of them were not written for the primary-care physician. This book covers the subject of pulmonary disease in the adult and older adult and is written for the primary-care physician, not the pulmonary specialist. With the exception of congenital and infectious problems, most of the pulmonary diseases encountered by the primary-care physician are seen in the older adult population. Chronic obstructive pulmonary disease, for example, is the second leading cause of disability in the United States, and lung cancer is the leading kind of cancer in men. Both diseases occur mostly among adults.

Prior to the 1950s, tuberculosis was the major interest of the pulmonary physician. The antituberculosis chemotherapy introduced then was so effective that virtually all of the tuberculosis hospitals and clinics in the United States have been closed. But the care of patients who still contract this disease now falls on primary-care physicians. Indeed, throughout pulmonary medicine the last three decades have brought challenges to primary-care physicians as well as to specialists by the enlargement of old problems, advances in knowledge, and extraordinary innovations in drugs, equipment, and methods.

While tuberculosis was being brought under control, other diseases were becoming more common or more adequately diagnosed. As a result of widespread use of cigarettes over the prior 50 years, obstructive lung disease and bronchogenic carcinoma, previously rare, have become serious national health problems. Remarkable advances in the understanding of normal and abnormal pulmonary physiology, which began to accelerate in the 1940s, have continued; and this knowledge has been applied to the diagnosis and treatment of obstructive and restrictive pulmonary diseases and respiratory failure.

Significant developments in pulmonary pathology—especially sputum

cytology—and in microbiology have accounted for a great deal of advancement in pulmonary medicine; and recent application of fiberoptic light transmission and visualization to bronchoscopy of the tracheobronchial tree has added much to our diagnostic capability.

As the scope of pulmonary medicine has widened, subspecialization has been inevitable. Pulmonary physiology, bronchoscopy, respiratory intensive care, lung oncology, and other aspects of pulmonary medicine have become full-time endeavors for many pulmonary physicians. There has been an explosion of new knowledge and new techniques. The contributors to this book have attempted to provide the reader with basic, clinically relevant material the primary-care physician can apply to the care of patients with lung disease.

A book of this type cannot be produced without the participation of many people. The contributors are all outstanding physicians who are involved in active clinical practice. Each has a special interest and extensive clinical and laboratory experience in the area about which he has written. Each of the authors represented here is a respected colleague and friend, and I am indebted to all of them for their help and support in this endeavor. I also wish to thank my secretary, Sue Olsen, for her invaluable help in the production of this book. Last, I wish to thank the Medical Graphics and Publications sections of the Mayo Clinic and the editor, Guy Whitehead, Ph.D., for their outstanding contributions to this project.

I sincerely hope that readers find the finished product valuable in the care of their patients.

DOUGLAS R. GRACEY

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Introduction and Diagnostic Methods

Douglas R. Gracey

This book is concerned with pulmonary diseases seen in the adult and older adult population. It is written for physicians who are not specialists in thoracic disease but must deal with pulmonary problems of such patients—the general internist, geriatric specialist, and family practitioner. Its discussions are practical, and thorough at that level, but it is not meant to be a reference source for the specialist in thoracic disease. For the reader who desires more detailed information, each chapter lists selected references.

Most books on thoracic disease contain several chapters dealing with the various diagnostic aids available for the evaluation of thoracic problems. I will cover some of the diagnostic methods in a general discussion stressing the newer diagnostic tools available. More extensive presentations of the history, physical examination of the chest, laboratory methods, chest radiology, endoscopy, and pulmonary physiology are available in the several excellent texts listed at the end of this chapter.

An adequate history, from a patient with pulmonary symptoms or an abnormal chest roentgenogram, includes a detailed family and occupational history. There is a clear relationship between many of the diseases covered in the following chapters and the hereditary and environmental background of the patient. Environmental exposure (occupational, home, and avocational) and smoking of cigarettes may be keys to the diagnosis of certain pulmonary problems. It is frequently worthwhile to ask the patient to list every occupation and hobby that he has ever had, starting with the first, including the duration of activity. A detailed effort to elicit a history of

pulmonary symptoms such as dyspnea, cough, sputum production, hemoptysis, chest pain, wheezing, and dysphagia is obviously required.

The physical examination remains an important part of the initial evaluation of chest symptoms. Adequate evaluation of the chest includes the time-honored sequence of inspection, palpation, percussion, and auscultation of breath sounds. Auscultation over the upper trachea, with observation of the wristwatch, while the patient performs a forced expiratory vital capacity maneuver (after inhaling all he can, exhaling it as fast as he can) provides a simple test of airway obstruction. Normal adults can deliver the total vital capacity in less than four seconds. Although the examination of the chest may give entirely normal results in cases of significant pulmonary disease, it is still an essential part of the initial evaluation, and positive findings may immediately point the physician in the proper direction for further diagnostic investigation. The discovery of clubbing of the nails, extrapulmonary sounds, cyanosis, hoarseness, Horner's syndrome, subcutaneous nodules, palpable lymph nodes, skin lesions, and other positive physical findings at the initial physical examination frequently saves the patient time and money, as these findings help determine the type and extent of diagnostic studies to be undertaken. Much is said about the physical examination in the following chapters, and I will not go into further detail at this point.

The chest roentgenogram is probably the most widely used diagnostic tool in chest medicine. Many physicians feel that chest roentgenography can replace the physical examination of the chest. This is obviously not true, for the chest roentgenogram sometimes reveals nothing abnormal when significant pulmonary disease is present. This is especially frequent in obstructive pulmonary disease, where an adequate physical examination may clearly demonstrate the basis for the patient's symptoms. On the other hand, the physical and roentgenographic findings both may be normal in patients with significant airway obstruction, and only pulmonary physiologic studies may lead to the diagnosis.

Often, special roentgenographic studies are required for adequate evaluation of pulmonary lesions. Stereoscopic, apical lordotic, lateral, lateral decubitus, and oblique films may be helpful in certain cases. Lateral decubitus films frequently show a surprisingly large pleural effusion in the patient with "blunted costophrenic angle" or subpulmonic effusion. Expiration films may reveal a small pneumothorax or show mediastinal shift in the patient with an obstructing lesion of a major bronchus. Tomograms of the lung may be helpful in evaluation of solitary pulmonary nodules, or in the search for cavitation, multiple metastatic nodules, involvement of hilar and mediastinal lymph nodes, major airway lesions, or in other special sit-

uations. When available, computed tomography (the CT scan) of the chest has been especially useful in certain circumstances in which plain tomography was relied on formerly—notably in searching the lungs for multiple metastatic lesions and in examining the mediastinum.

Fluoroscopy is an excellent means for studying the dynamics of the chest wall, diaphragm, and mediastinum and is particularly suited to detection of expiratory and inspiratory mediastinal shift and of diaphragmatic paralysis. For diagnosing unilateral diaphragmatic paralysis, the "sniff test" remains the best method. The patient, under fluoroscopic observation, is asked to sniff vigorously; if one hemidiaphragm is paralyzed, the normal hemidiaphragm will move down rapidly while the paralyzed side moves up paradoxically.

Ventilation-perfusion lung scans are now widely available, and they are helpful in the evaluation of pulmonary vascular problems such as embolism. In addition, evaluation of regional lung function, as in bullous lung disease, is possible with this technique. In most institutions the ventilation-perfusion scan has replaced the double bronchospirometer and Carlen's tube in the study of differential lung function.

Pulmonary angiography remains the most specific method of diagnosing pulmonary embolism and is indicated in certain cases where this disease is suspected. Ventilation-perfusion scans and arterial oxygen tension measurements have supplanted pulmonary angiography in diagnosing pulmonary embolism in many institutions. However, several authors have pointed out that there are some cases in which adequate evaluation of pulmonary embolic disease cannot be done without angiography. Pulmonary angiography may be indicated also in certain circumstances to determine whether there is neoplastic involvement of the superior vena cava, pulmonary arteries, or pericardium. It may be helpful also in evaluating the extent of bullous emphysema and the status of the vasculature of the uninvolved lung, although this usually is done only when surgical resection of bullae is being considered.

Fungal and mycobacterial skin testing, fungal serologic examination, viral titers, sputum cytologic and bacteriologic evaluation, studies of hematologic, biochemical, and pleural fluids, and various lung biopsy procedures are all well covered in the following chapters.

Bronchoscopy, esophagoscopy, laryngoscopy, thoracoscopy, and mediastinoscopy are standard methods of the thoracic disease specialist and thoracic surgeon, but they are beyond the scope of this discussion. The introduction of the fiberoptic bronchoscope has revolutionized bronchoscopy, making it so much less traumatic and more easily performed. Fiberoptic bronchoscopy has greatly increased the ability to evaluate more distal and

less accessible areas of the tracheobronchial tree, especially the upper lobes; likewise, it has greatly improved the ability to brush and to perform biopsies of distal lesions under fluoroscopic guidance.

Many of the subsequent chapters will discuss various pulmonary physiologic tests and physiologic patterns of abnormality. A brief discussion of pulmonary physiologic testing is, therefore, appropriate here. For the reader who wishes to obtain more extensive information, appropriate references are listed at the end of this chapter. Especially suitable are the books by John B. West, Julius Comroe, and J. F. Nunn.

Testing of pulmonary function is an essential part of the evaluation of certain cases of pulmonary disease. It is important in confirming a clinical diagnosis and in measuring the degree of impairment—as in assessing operative risk or disability, or the course of a disease, or the response to specific therapy. However, except for the assessment of airway obstruction, pulmonary function tests are not diagnostic tests. They do not provide a diagnosis; they do measure the type and degree of abnormality.

Standard pulmonary function tests include measurements of static lung volumes and of flow rates. The static lung volumes are classified as four primary *volumes,* which are individual lung subdivisions, and four lung *capacities,* which are the sums of two or more volume compartments. The basic terms for volumes and capacities are as follows.

Primary lung volumes:

VT—tidal volume
: Volume of gas in one quiet, normal exhalation

RV—residual volume
: Volume of gas remaining in thorax after maximal exhalation

ERV—expiratory reserve volume
: Maximal volume of gas that can be exhaled after a quiet, normal exhalation

IRV—inspiratory reserve volume
: Maximal volume of gas that can be inhaled after a quiet, normal inspiration

Lung capacities:

TLC—total lung capacity
: Total volume of gas in thorax at maximal inhalation
: Sum of the four primary lung volumes

FRC—functional residual capacity
: Volume of gas remaining in thorax after quiet, ordinary exhalation
: Sum, ERV + RV

VC—vital capacity
: Maximal volume of gas that can be exhaled after a maximum inhalation