

Pulmonary Diseases

Edited By

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PREFACE

PULMONARY diseases constitute a formidable proportion of the acute and chronic illnesses which the clinician is called upon to diagnose and to treat, especially if one includes the associated pulmonary manifestations of cardiovascular diseases. In recent years pulmonary diseases have assumed increasing importance for several reasons. The widespread use of mass screening techniques by photofluorography and intracutaneous testing are discovering active disease processes as well as asymptomatic or incipient pulmonary conditions, the effective management of which poses fascinating problems in clinical practice. The incidence of diverse pulmonary diseases continues to undergo change, the decline of some, the accession of others. Increased knowledge of respiratory physiology has permitted the development of diagnostic techniques and the application of therapeutic approaches which have enhanced the clinical management of many pulmonary diseases. There is growing appreciation that the respiratory system is linked intimately to the physiology of the organism as a whole, and many diagnostic and therapeutic endeavors in extrapulmonary diseases take advantage of this relationship. Definitive management, such as chemotherapy, the antibiotics, surgical procedures and the like, are now permissible for a wide gamut of pulmonary diseases; unfortunately, for many other pulmonary conditions symptomatic and supportive therapy remain the mainstay of clinical management. Improved control of many pulmonary disorders has resulted from greater knowledge of the epidemiology of communicable diseases and more effective methods of public health and preventive medicine.

As with disease elsewhere in the body, the classification of pulmonary diseases should consider the five component parts of a complete medical diagnosis: the etiology of the condition, the anatomical changes resulting therefrom, the physiologic disturbances invoked by the disease process, the alterations in the functional capacity of the patient to carry on, and the therapeutic response to both specific and nonspecific forms of management. This concept of a complete medical diagnosis has long been advocated by the New York Heart Association in cardiac disease. With modification this classification may be adapted to pulmonary diseases. Certainly the concept emphasizes the need for an evaluation of the patient as a whole and that no one diagnostic technique in and of itself, whether it be the medical history, the physical examination, roentgenographic or other laboratory procedures, will suffice to complete the diagnosis. This concept also emphasizes that our present classification of pulmonary diseases is incomplete and that there are gaps in our knowledge of pulmonary disorders. The classification that we have adopted in this volume is a workable one subject to any alterations that the clinician finds advisable.

This volume, a collaborative one by twenty authors, presents the field of pulmonary diseases from the clinical viewpoint. Brief reviews of

anatomy, physiology and pathology of various processes have been included wherever such presentations will enhance clinical understanding, but the emphasis dwells chiefly on the diagnosis and treatment of pulmonary diseases.

The editor takes pleasure in expressing acknowledgements for assistance in the preparation of this book: to each contributor who has given so cheerfully of his time and efforts and without whose aid this book would not have been possible; to Dr. Julius Lane Wilson, Professor of Medicine in the Henry Phipps Institute of the University of Pennsylvania, for invaluable advice concerning the organization and arrangement; to Dr. Thomas H. Burford, Professor of Thoracic Surgery, Washington University School of Medicine, for generous assistance on the surgical sections; to Miss Brent Robertson for painstaking attention to the editorial details of the manuscript; to the publishers, Lea & Febiger, for their faithful reproduction of the book; and to his wife, Gwendolen Williams Pullen, for her support and encouragement throughout the many months of preparation of this book.

Roscoe L. Pullen

Columbia, Missouri

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I

THE PHYSIOLOGIC BASIS OF PULMONARY DISEASE

By FRANKLIN C. MASSEY, M.D.

PHYSIOLOGIC ANATOMY OF THE BRONCHI, LUNGS AND PLEURA

The Tracheobronchial Tree and Bronchopulmonary Segments

EVEN the anthropologist has no interest in the anatomy of the bronchi, lungs and pleura as static intrathoracic structures. The lower respiratory tree deserves his attention only because of its implications upon man's *development*. From anthropological to cytological-physiological extremes there are interpolated many attitudes and approaches to the purpose of the intrathoracic respiratory structures but none of these excludes consideration of their *functional* significance.

The trachea, bronchi and bronchioles down to the terminal bronchioles, while primarily conduits for the passage of gases and vapors, are involved vitally in the maintenance of proper tensions of carbon dioxide and oxygen and hence in the regulation of acid-base balance of the blood. (See *Physiology of the Lungs*, p. 19.) Unimpeded ingress and egress of air through this tracheobronchial tree is essential for normal respiration.

The trachea is the largest, uppermost segment of the lower respiratory tree and extends from the larynx into the thorax. Bifurcating from the trachea, there are a right and a left main bronchus. Anteriorly, this branching is at the level of the second costal cartilage, while posteriorly it is found to lie between the fourth and fifth thoracic vertebrae.

"The *right main bronchus* is shorter, wider, and more nearly vertical than its fellow of the opposite side, and is practically the continuation of the trachea, while the *left main bronchus* might be considered as a branch. The deviation of the right main bronchus is about 25 degrees, and its length unbranched in the adult is very short; the proximal margin of its orifice is on a level with the carina. The deviation of the left main bronchus is about 75 degrees, and its adult length is about 5 cm. The right main bronchus, considered as a stem, may be said to give off three branches: the *upper lobe bronchus*, the *middle lobe bronchus*, and the continuation downward, called the *lower lobe bronchus*. The left main bronchus gives off first the *left upper lobe bronchus*, and then continues downward as the *left lower lobe bronchus*. The branches of these lobar bronchi may be called

segmental bronchi, and the corresponding portions of the lobes which they supply may be called *broncho-pulmonary segments*. The right upper lobe is divided into three principal or major segments which are called, according to the terminology suggested by Jackson and Huber, *apical*, *anterior* and *posterior*; the middle lobe into two: *medial* and *lateral*; and the lower into five: *superior*, *medial basal*, *anterior basal*, *lateral basal* and *posterior basal*. On the left side, the upper lobe is divided into an *upper division* and a *lower "lingular" division*, this latter portion of the left upper lobe being analogous to the middle lobe on the opposite side. The upper division of the left upper lobe is divided into two major segments, the *apical* (or *apical-posterior*) and the *anterior*; the lower or "lingular" division is also divided into two segments, located one above the other, which may be called the *superior* and *inferior* segments. The left lower lobe is divided exactly as the right except that the medial basal segment forms a part of the anterior basal. The segments of the left lower lobe are, therefore: *superior*, *anterior basal* (or anterior-medial basal), *lateral basal* and *posterior basal*." (Jackson and Jackson.) (See Figs. 1-6.)

Establishment of this more precise nomenclature of the lung aids the internist, bronchoscopist and thoracic surgeon immeasurably. By exact designation of the specific bronchopulmonary segments involved in a pathologic process, diagnosis has become more direct and treatment more efficient. From the viewpoint of pathogenesis of disease, it is more understandable when one knows the structural differences of the pulmonary apparatus, why foreign body aspiration and bacterial invasion is more frequent, for example, in the right lung.

The bronchial tree is a musculofibrous structure, with a ciliated lining, which is capable of longitudinal elongation and contraction; and luminal size changes. Elastic fibers are arranged plentifully along the axis of the conduit, in the tunica propria, extending along to the alveoli. Recoil is permitted by this architecture, while decrease in the size of the lumen is achieved through contraction of circular smooth muscle fibers which envelope the bronchi progressively more completely toward the bronchioles.

The following bronchographic studies and companion diagrams represent a portion of the exhibit, "Bronchographic Studies in Bronchiectasis Before and After Pulmonary Resection," awarded Honorable Mention at the Convention of the American Medical Association, Chicago, Illinois, 1952. These drawings, together with their film transparencies, were used to show normal bronchograms, to enable the viewer to compare them with the abnormals.

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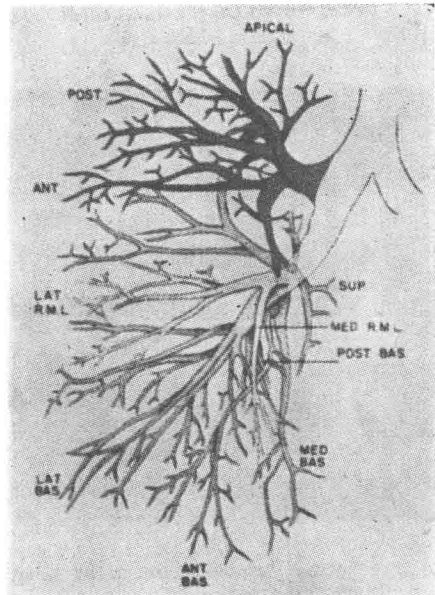
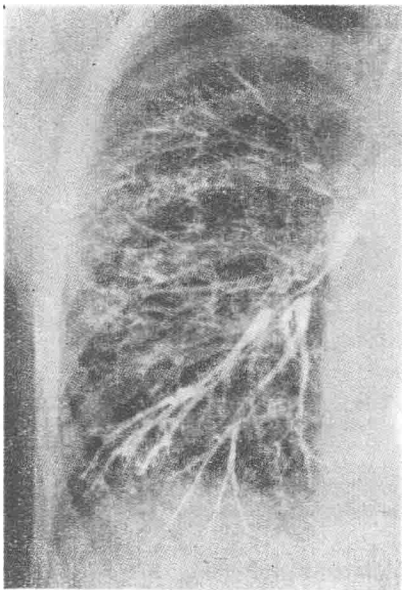


FIG. 1.—Normal bronchogram, right lung, Postero-anterior Projection. Accompanying diagrammatic sketch shaded to delineate distribution of bronchi by lobes.

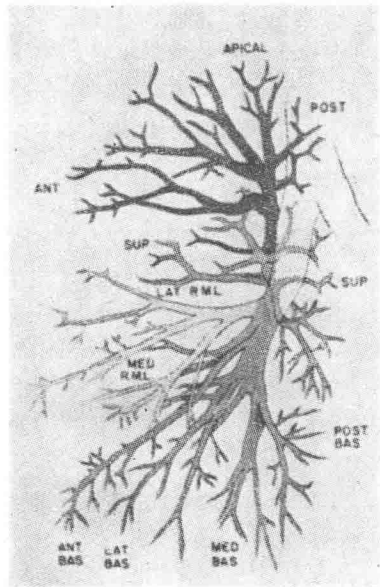
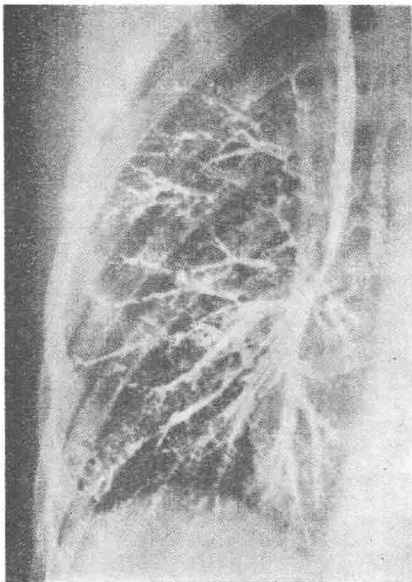


FIG. 2.—Normal bronchogram, right lung, Left anterior oblique Projection. Accompanying diagrammatic sketch shaded to delineate distribution of bronchi by lobes.

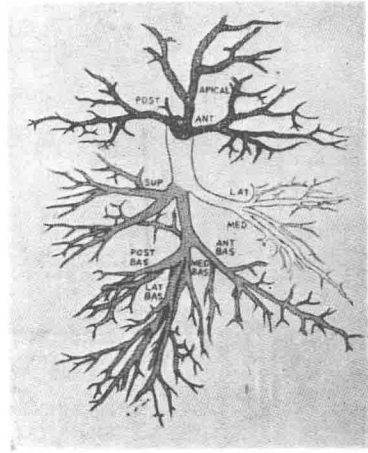
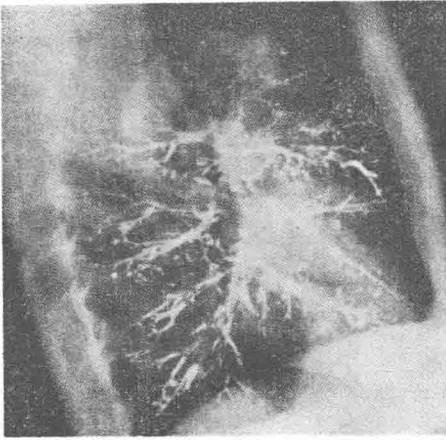


FIG. 3.—Normal bronchogram, right lung, Right lateral projection. Accompanying diagrammatic sketch shaded to delineate distribution of bronchi by lobes.

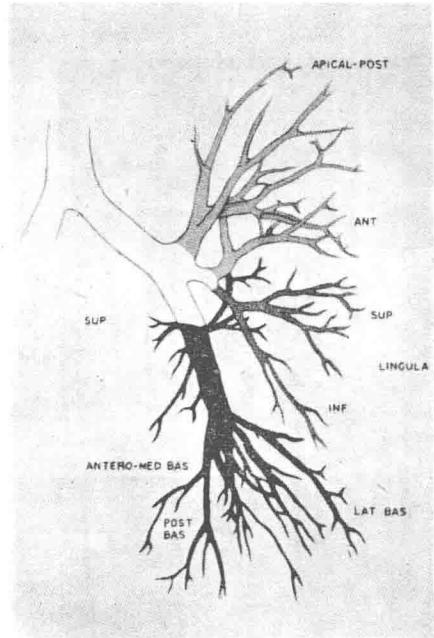
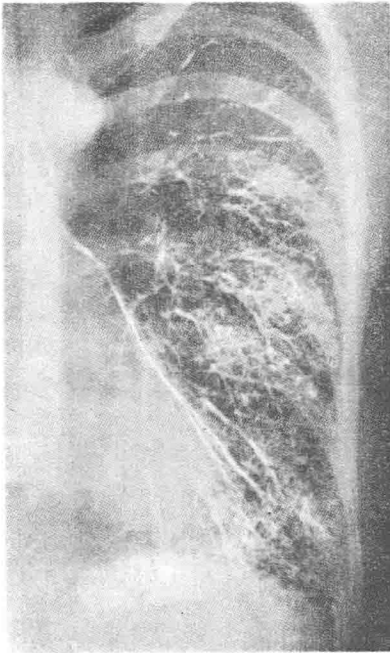


FIG. 4.—Normal bronchogram, left lung, Postero-anterior Projection. Accompanying diagrammatic sketch shaded to delineate distribution of bronchi by lobes.