Anatomy and Physiology of the Respiratory Tract

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CONTENTS
INTRODUCTION
ANATOMY
PHYSIOLOGY
SOURCES

INTRODUCTION

The anatomy and physiology of the respiratory tract is quite complex. Each anatomic segment performs in concert with the others and is accountable for a wide variety of physiological responsibilities. These responsibilities vary with rest or exercise, disease or health. Throughout this book, the reader will discover that the respiratory tract is a delicate and complicated system that can be involved in a number of disease processes. An understanding of the anatomy and physiology of the respiratory tract is critical to understanding this elaborate system to maintain respiratory health and treat respiratory diseases.

ANATOMY

The respiratory system is comprised of several elements including the central nervous system, the chest wall, the pulmonary circulation, and the respiratory tract. The respiratory tract can be divided into four distinct segments: the naso-oropharynx, the conducting airways, the respiratory bronchioles, and the alveoli. The lungs can also be divided into the conducting airways and the units of respiration. The trachea, bronchi, and bronchioles conduct and transport air from the outside world and deliver it to the respiratory units—the alveoli. Gas
exchange occurs at the level of the alveoli, providing the necessary oxygen for the body’s daily functions. Malfunction of any of these components can lead to the myriad respiratory disorders discussed in this book.

The first segment of the respiratory tract is the naso-oropharynx (see Fig. 1), which begins with the nostrils and lips, and includes the nasal passage, sinuses, and glottis until reaching the trachea. The purpose of the naso-oropharynx is to filter out any large particles and to humidify and warm the air that is delivered to the respiratory units. The epiglottis and muscles of the larynx coordinate the passage of food and air, and generally assure that food reaches the esophagus and air reaches the trachea.

The next segment is the conducting airways, beginning with the trachea, which branches repeatedly to form approximately 14 generations of conduits for air reaching several distinct pulmonary segments. The trachea bifurcates at the carina into the right and left mainstem bronchi. Aspiration occurs more commonly at the right main bronchus because of its gentler angle off the trachea. The right lung is divided into upper, middle, and lower lobes, each of which is further subdivided into segments and each with its own conducting airway. The upper lobe contains three segments: the apical, posterior, and anterior. The middle lobe consists of the lateral and medial segments. The lower lobe has five segments: the superior, medial basal, anterior basal, lateral basal, and posterior basal. The right lung has 10 segments, as opposed to 8 found in the left lung. The left main bronchus has two divisions serving the left upper lobe. The superior division of the bronchus leads to the apical–posterior and anterior segments. The inferior division of the bronchus leads to the superior and inferior lingular segments. The left lower lobe consists of the superior, anteromedial basal, lateral basal, and posterior basal segments. Each bronchopulmonary segment is supplied by an individual branch of the pulmonary artery.