Radiographic Evaluation of Sleep-Disordered Breathing

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KEYWORDS

• CBCT • Airway • Obstructive sleep apnea • Sleep-disordered breathing

KEY POINTS

- Anatomy and anatomic variations of the pediatric and adult airway, extending from the nasopharynx to the hypopharynx, are described.
- Airway anatomy and pathologies that relate to sleep-disordered breathing are discussed.
- Protocols for 3-dimensional radiographic interpretation of the airway are reviewed.

INTRODUCTION

In the litany of diseases afflicting modern civilizations, sleep-disordered breathing (SDB) is rapidly increasing in prevalence and financial impact on Western societies.[1] Comorbidities include hypertension, myocardial infarction, stroke, memory loss, diabetes, depression, insomnia, and daytime drowsiness. With a range of medical and surgical treatments each targeting a different aspect of the disease, it behooves providers to have an understanding of the anatomic, hereditary, environmental, and lifestyle considerations that play a role. This discussion focuses on the anatomic features pertinent to obstructive SDB.

In the current era, 3-dimensional imaging of the upper respiratory tract—specifically, cone beam computed tomography (CBCT) scans—aid in the prediction and diagnosis of patients who suffer from obstructive SDB. CBCTs are increasingly being used routinely for their value in providing general dental care, and as such can be an invaluable screening tool for identifying patients with potential obstructive SDB. For practitioners regularly acquiring such scans, it is imperative to become well-versed in the radiographic anatomy of the upper respiratory tract, including normal appearance, common abnormalities, incidental findings, and common pathologies that might increase the risk for SDB.[1]

CLINICAL ANATOMY OF THE UPPER RESPIRATORY TRACT

The upper respiratory tract extends from the nares to the larynx, encompassing the nasal and oral airways (**Fig. 1**). The nasal cavity extends from the nares to the posterior choanae, comprising the external nasal valves, internal nasal valves, nasal septum, and turbinates. The external nasal valve involves the lower lateral cartilages, the nasal septum, and floor. The internal nasal valve is found at the junction between the upper lateral cartilages and the septum, and should form an angle between 10° and 15°. The nasal septum, at the midline, is composed of the vomer, the perpendicular plate, and septal cartilage. The septum should be relatively straight with no significant deviations. The lateral walls of the nasal cavity should be either straight or slightly concave, upon which sit the 3 paired turbinates. The inferior and middle nasal turbinates should be relatively symmetric

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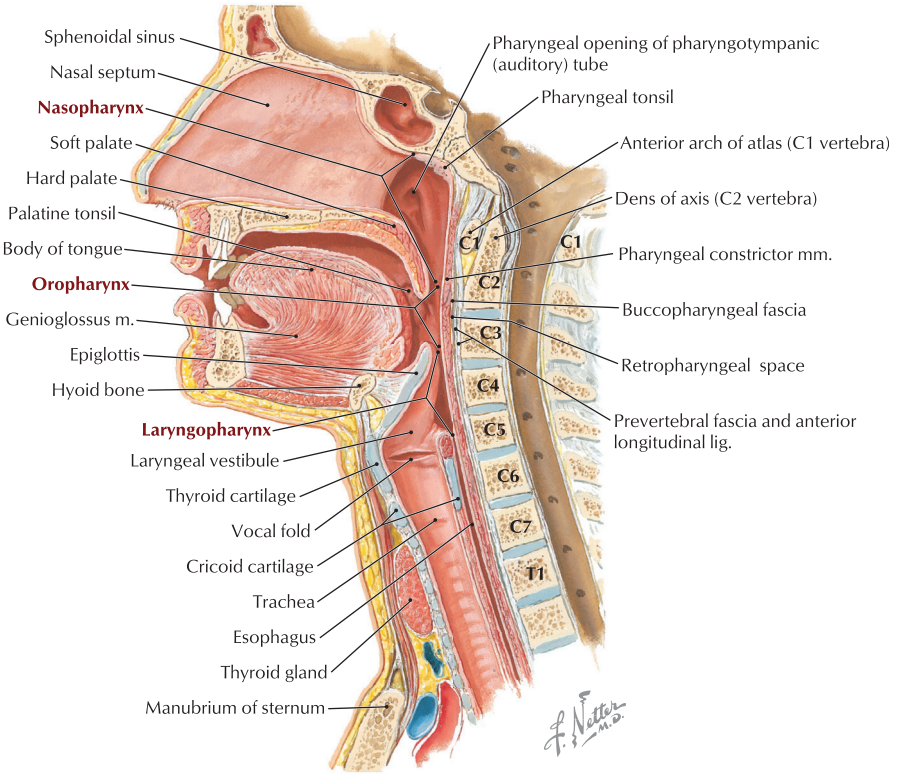

Fig. 1. Graphic from Netter's Anatomy shows the sagittal midline anatomy of the upper respiratory tract. (*Courtesy of* www.netterimages.com; with permission of Elsevier.)

and inferolaterally curved, with the concave surface facing toward lateral wall of the nasal cavity (**Fig. 2**).[2]

The nasopharynx begins at the posterior choanae and extends to the level of the hard palate. It is lined in the upper aspect with adenoidal tissue of varying thickness (**Fig. 3**). This tissue is sometimes referred to as the pharyngeal tonsils. The oropharynx begins at the level of the hard palate and includes the soft palate and uvula. Inferior to the uvula, along the lateral walls of the oropharynx posterior to the base of the tongue, paired palatine tonsils are present, as well as tonsils at the base of the tongue. Along with the pharyngeal tonsils, this collective of lymphoid tissue is often referred to as Waldeyer's ring. The hypopharynx begins at the base of the tongue, includes the epiglottis, and extends to the paired vocal cords.[2]

ANATOMIC VARIATIONS OF CLINICAL SIGNIFICANCE

Many normal variations of the upper respiratory tract can cause restricted airflow. Although these findings are not considered pathologic, they are important to recognize and identify as possible contributors to SDB.

Nasal Cavity

The external and internal nasal valves have the smallest cross-sectional area (and therefore the highest resistance) of the passageways in the upper respiratory tract. Constricted nasal valves

Fig. 2. Coronal cone beam computed tomography at the level of the nasal fossa and maxillary sinuses shows normal sinus, turbinate, and septal anatomy.