Chapter 7. Treatment Planning: Nasal Function

- *Nasal function*: For numerous reasons, breathing through the nose is more beneficial than breathing through the mouth. Humidification occurs as the air passes from the nose to the lungs. In fact, 90% of humidification occurs before the air reaches the lungs across the turbinates (Figures 7-1 and 7-2). Air can be heated as much as 25°C to 30°C during inspiration, and the nose plays a large role in thermal regulation.[1,2] Particulate filtration occurs in the nasal vibrissae just inside the nares where large particles may be trapped. Impingement is a process where smaller particles are filtered, and the two areas where this occurs are the internal nasal valve and the posterior nasopharynx. The mucociliary system also plays a major role in particulate filtration.[3]
- *Nasal physiology*: As one breathes through the nose, the regular pace of the respiratory cycle is maintained. Afferent stimuli from nerve endings in the nose travel to the brain to control the rhythm and rate of breathing. Additionally, the brain senses the efflux of carbon dioxide and responds by maintaining a normal tone in the pulmonary vasculature and a normal production of mucus. Breathing through the mouth bypasses these nerve endings, disrupting the respiratory cycle and stimulating the brain to produce larger amounts of mucus and increase pulmonary vascular resistance. Chronic increases in vascular resistance lead to pulmonary hypertension. With expiration, air exits the nose across a smaller cross-sectional area, which creates back-pressure in the respiratory tree. This keeps the terminal alveoli open longer permitting more time for gas exchange. Too rapid a loss of carbon dioxide, as occurs with hyperventilation, alters the pH of the blood.[4]
- *Nasal cycle*: Normally, there is a cyclical enlargement and contraction of the nasal mucosa that alternates between nostrils: When one side is engorging, the other is contracting. This cycle may take between 1 and 5 hours and its purpose is unknown.[3]
- *History*: Many factors are considered in elucidating the etiology of nasal obstructive symptoms: duration, frequency, laterality, and seasonality. The patient should be questioned about a history of trauma, allergies, and medications. Seasonal or geographic symptoms are typical of a disorder that is best treated medically. Obstruction only in deep inspiration or heavy breathing is characteristic of a collapsed internal nasal valve, whereas an obstruction that is constant is indicative of a fixed mechanical obstruction such as an enlarged turbinate or septal deviation.

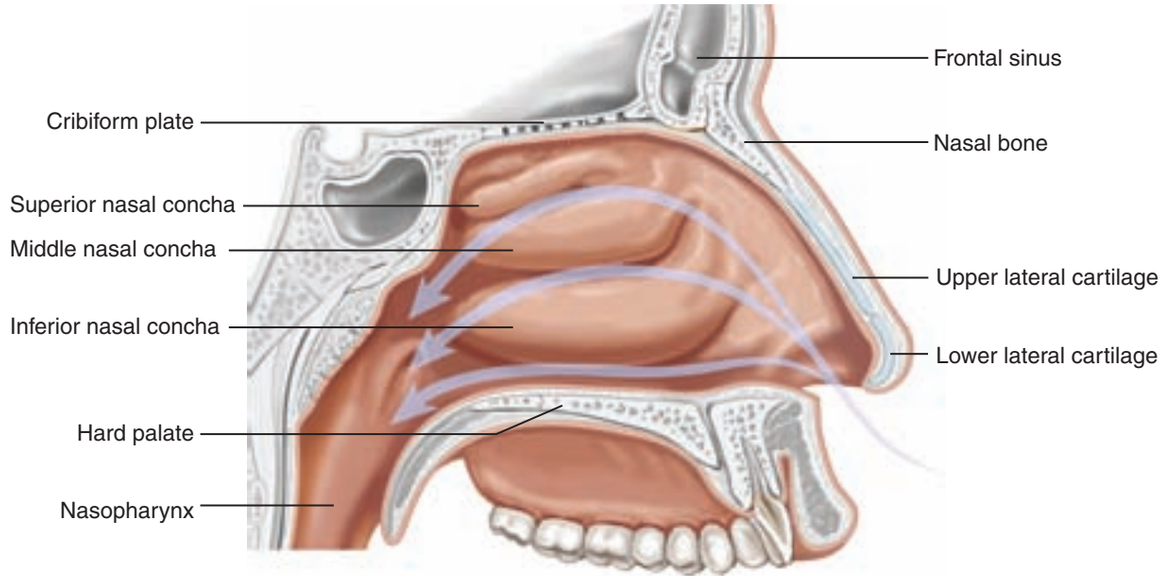

Figure 7-1. Lateral nasal sidewall anatomy.

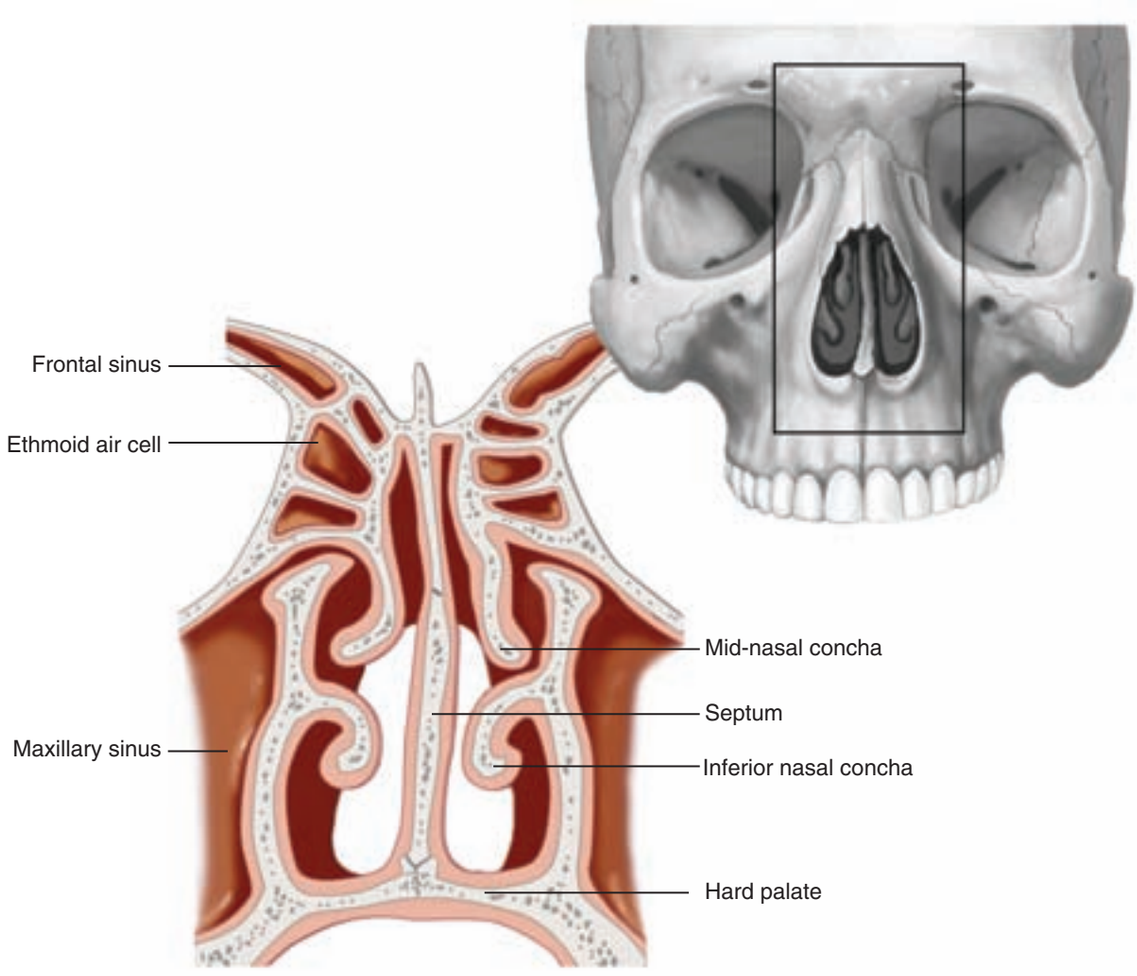

Figure 7-2. Nasal cavity cross-section.

- *External examination*: Examination of the nasal morphology may reveal potential sources of airflow obstruction.
  - The lower lateral cartilages provide support to the alar rims and serve to keep the external nasal valves open (Figure 7-3). Any abnormalities or collapse of this external nasal valve with inspiration should be noted and evaluated. The static position of the septum from a worm's eye view should be noted. Caudal deviation may be noted by visualization of the caudal edge of the septum within either of the two nostrils. Nasal deviation from frontal view may also be indicative of an obstructive septal deviation.
  - The skin over the internal nasal valve should also be noted with and without deep inspiration. Medial excursion of this skin may be indicative of internal valve collapse. Simple observation should note whether these valves remain open or collapse on inspiration, indicating the degree to which the lower lateral cartilages provide adequate alar support.
  - The Cottle maneuver is an additional test to identify compromise of the internal nasal valve (Figure 7-4). The patient is asked to breathe in and out through the nose while the opposite nostril is held closed. This breathing is done with and without lateral traction on the cheek. Any difference in the ease of respiration is noted, and "significant" improvement in respiration is taken as a positive test. Gruber et al. reported improved accuracy in diagnosing nasal valve compromise using commercially available strips to individually spread the upper and lower lateral cartilages to separately evaluate internal and external valves, respectively.[5]

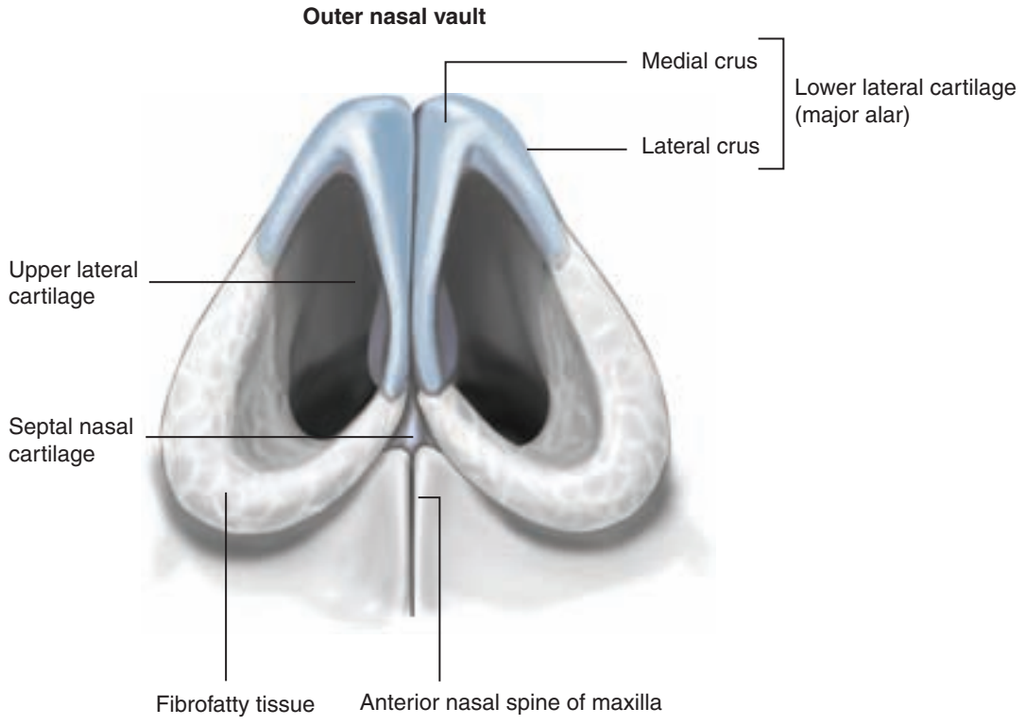

Figure 7-3. Nasal base on worm's eye view.

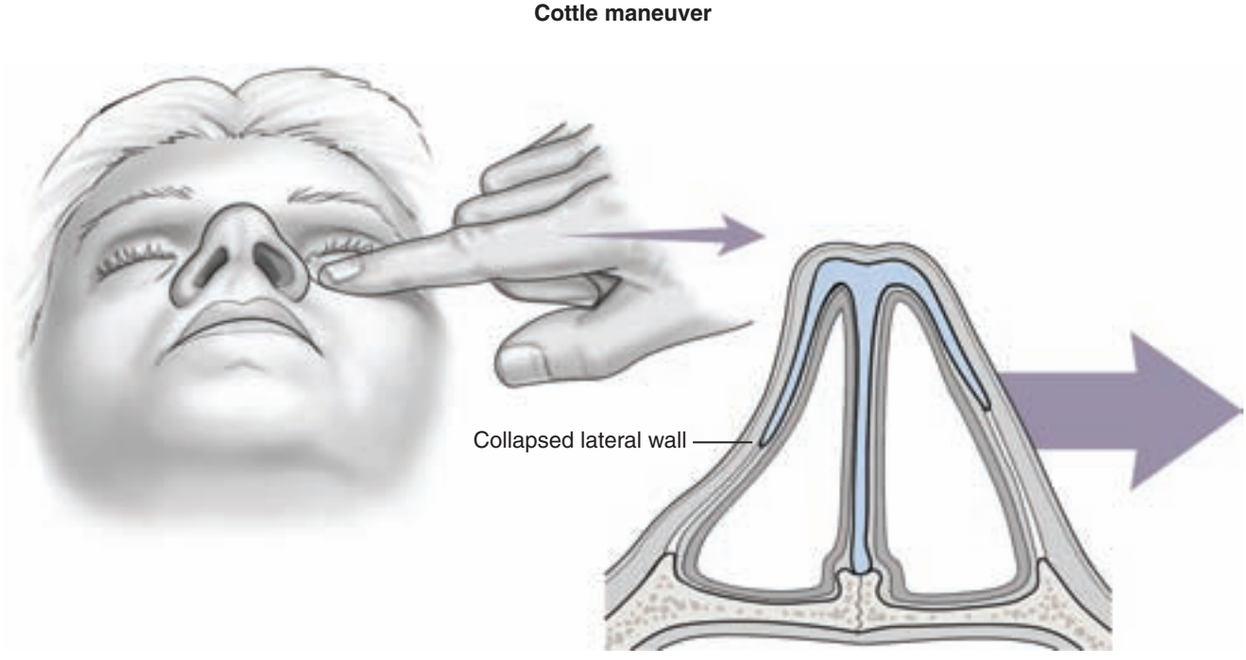

Figure 7-4. Cottle maneuver to identify internal valve collapse.

- *Intranasal examination*: Using a nasal speculum and adequate lighting, the internal anatomy of the nose should always be assessed. This should be performed before and after use of a vasoconstrictive agent, such as oxymetazoline. Any scar tissue, webs, or narrowing should be identified. These may affect blood flow through either the external or internal nasal valve. The angle the upper lateral cartilages make with the septum should also be noted (Figures 7-5). An angle of 15 degrees or greater is felt to be adequate for unimpeded airflow Examination while the patient inspires may provide additional evidence of compromised function.
  - The position of the more central septum should be noted, taking care to describe any defects or deformity. Deformities of the septum may be in the anterior-posterior plane, the sagittal plane, or a combination of both. The caudal border may rest in the center of the anterior nasal spine or lateral to it. The caudal margin may be palpated through the overlying columellar skin and soft tissue. A cotton-tipped applicator is used to palpate the septum and determine if sufficient stock exists for graft harvest. The presence, size, and location of any septal perforations should be documented as well.
  - The turbinates comprise the bulk of the surface area of the nasal mucosa and play an integral role in respiration. There are three stacked turbinates in the superior-inferior plane. The inferior turbinate is the most visible when looking into the vestibule and is the most responsible for altering nasal airflow. The middle and superior turbinates are more difficult to visualize.
- Swelling of the nasal turbinates, due to allergy or exposure to environmental irritants, may lead to blockage of the airway. Treatment of the underlying cause may reduce the swelling but often more drastic measures are indicated. Generally, because the turbinates are essential for respiration, only small amounts of turbinate tissue should be removed.
- Some surgeons routinely measure nasal airflow and pressure during respiration preoperatively and postoperatively by rhinomanometry. This serves to quantify the amount of existing resistance and the improvement following surgery. Symptomatic patients generally record values above 0.3 Pa/mL/s.[6] Active rhinomanometry measures flow and resistance from the normal respiratory cycle.[7] It samples data from either a sensor just inside the nasal vestibule, in the nasopharynx, or in the oropharynx. Acoustic rhinometry is a newer type of rhinometry that measures airflow based on acoustic reflections noninvasively.[8] In general, nasal obstruction may result from either hypertrophy of the mucosa, altered nasal anatomy, or a combination of the two. A mucosal etiology is suggested by diminution in resistance following use of a nasal decongestant.

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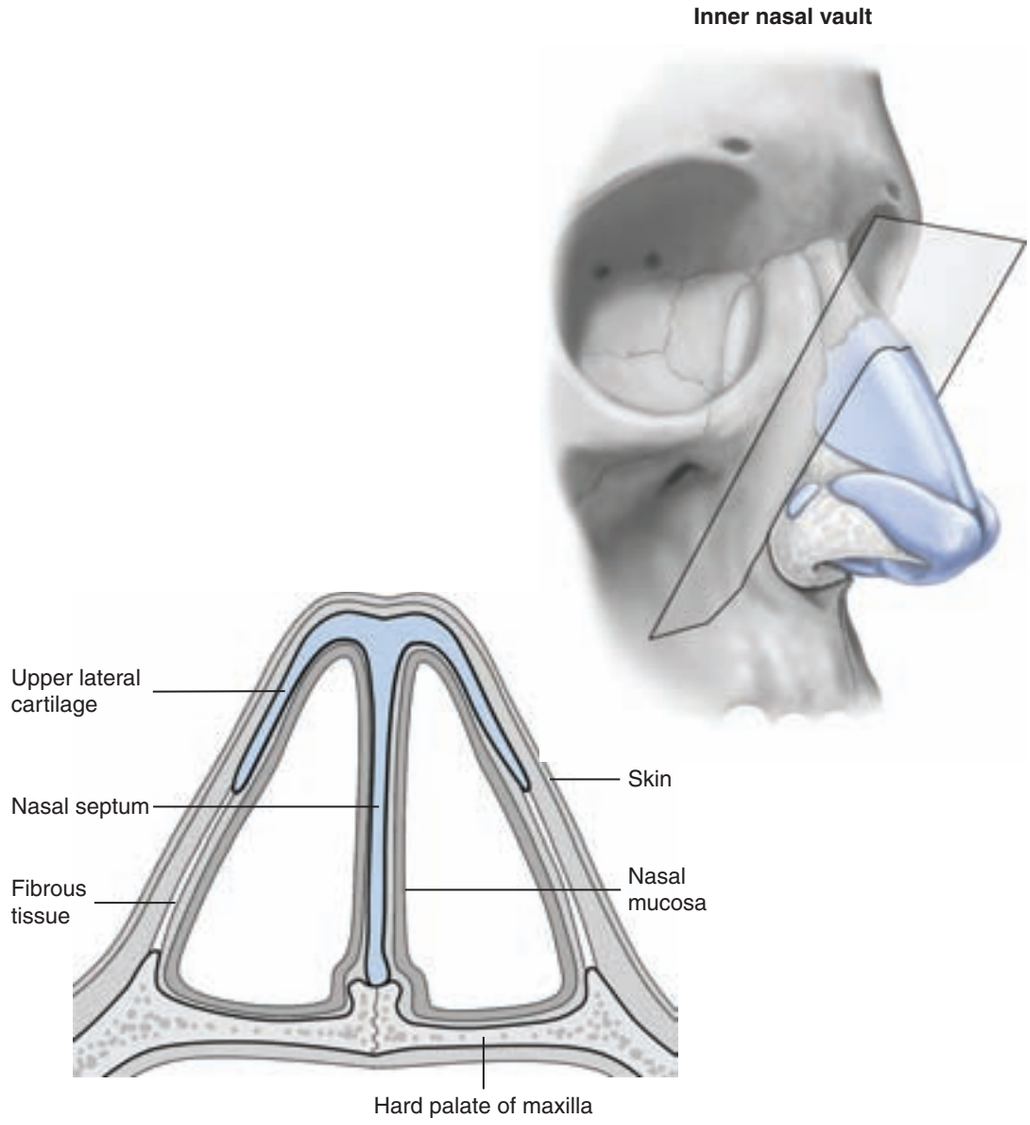

Figure 7-5. Nasal cavity at the level of the internal nasal valve shown above.