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Inferior turbinate reduction

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The inferior turbinate is an important structure serving a vital role in nasal physiology. However, inferior turbinate enlargement can lead to decreased nasal airflow and a sensation of nasal obstruction. Chronic nasal obstruction can substantially affect quality of life, productivity, and finances, and when medical therapies fail, surgical management is often recommended. Many techniques for inferior turbinate reduction exist, including outfracturing, submucosal soft tissue reduction (ie, electrocautery, radiofrequency coblation, and powered microdebrider), submucosal bone removal, argon plasma coagulation, laser reduction, partial turbinectomy, and total turbinectomy. These techniques have demonstrated varied long-term results, and there remains a lack of consensus as to the optimal surgical technique. However, given the important role the inferior turbinates play in nasal physiology, many contemporary surgeons aim to strike a balance between adequate tissue resection for symptom improvement and preservation of functional turbinate tissue and its contribution to normal nasal physiology.

Introduction

The inferior turbinate is an important structure, serving a vital role in nasal physiology. It has many functions, including the filtration, warming, and humidification of inspired air, in addition to the regulation of nasal airflow. However, inferior turbinate enlargement, due to hypertrophy or edema, can lead to decreased nasal airflow, and subsequently, a sensation of nasal obstruction. Chronic nasal obstruction can substantially affect quality of life, productivity, and finances.[1,2] A number of medical therapies exist to treat patients with nasal obstruction secondary to enlarged inferior turbinates; however, when these medical therapies fail, surgical management is often recommended. The focus of this article is a wide variety of surgical techniques that have been described to reduce the size of enlarged inferior turbinates when medical management has yielded unsatisfactory results.

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Indications, patient selection, and workup

Inferior turbinate reduction is one of the most commonly performed sinonasal surgical procedure, and the most common indication for turbinate reduction is nasal obstruction due to inferior turbinate enlargement. In addition to relief of nasal obstruction, inferior turbinate reduction may also play a role in the treatment of adult and pediatric sleep-disordered breathing.[3,4] There are numerous possible etiologies for inferior turbinate enlargement. This includes physiological, anatomical, or pathophysiological causes, such as allergic, vasomotor, and hormonal rhinitis, as well as systemic inflammatory diseases. As such, an assessment for allergic and other systemic etiologies is a crucial component of a comprehensive medical history of any patient being evaluated for nasal obstruction. Physical examination should include anterior rhinoscopy and nasal endoscopy, before and after nasal decongestion, to differentiate between possible bony and soft tissue contributions to turbinate enlargement and the patient's symptoms. Before considering surgical intervention, treatment typically consists of medical therapy, which may include topical nasal steroids, antihistamines, and nasal saline irrigations.[5]

Anatomy

The inferior turbinate is composed of a central bony portion that projects from the medial aspect of the maxillary and palatine bones at varying angles, and is surrounded medially, laterally, and inferiorly by a layer of soft tissue. This soft tissue layer, which is thickest along the medial aspect of inferior turbinate, is composed of erectile tissue with seromucinous glands and venous sinusoids and is covered by pseudostratified ciliated columnar epithelium.[5,6] The venous sinusoids play a significant role in the regulation of mucosal thickness and are controlled by sympathetically innervated arterial resistance vessels. The inferior turbinate has a rich, variable blood supply, mainly provided by the posteriorly located inferior turbinate branch of the posterior lateral nasal artery, originating from the sphenopalatine artery.[7]

Inferior turbinate function

The inferior turbinates play an important role in nasal physiology. By increasing the mucosal surface area in the nasal cavity, the turbinates serve to warm and humidify inspired air, and thus facilitate pulmonary alveolar gas exchange. Furthermore, the orientation and shape of the turbinates streamline inspired air posteriorly, while providing sufficient resistance to decrease airflow velocity and change it from a laminar to a transitional pattern.[5,8] This increase in turbulence aids in the filtration function of the nasal cavity, by allowing for the trapping of inspired debris in the mucus layer of the nasal epithelium, which then serves to remove the debris from the nasal cavity through mucociliary clearance. When nasal resistance is abnormally low (eg, owing to excessive inferior turbinate surgical reduction), the altered airflow and resistance patterns may lead to paradoxical subjective complaints of nasal obstruction, known as "empty nose syndrome."[5,9]

Most people experience irregularly alternating asymmetric airflow through the nose, commonly referred to as "the nasal cycle," due to alternating engorgement within the nasal erectile mucosa, and especially that of the inferior turbinates. At any given time, one side of the nasal passages is typically more congested with a reduced amount of secretions, whereas the contralateral nasal cavity is more widely patent but has increased secretions from serous and mucus glands. Despite the constant fluctuation of each individual turbinate size and ipsilateral airway resistance, the total resistance of the whole nasal airway has been noted to be constant, as described by Kayser in 1895.[5,10]

Surgical technique

Numerous surgical techniques have been described for the treatment of inferior turbinate hypertrophy, and there remains a lack of consensus as to the optimal technique. These surgical techniques differ in the amount and type of tissue resection and preservation (Figure 1). As our understanding of nasal physiology has grown, surgical techniques have also evolved with the aim to achieve both maximal symptom improvement and preservation of function. Furthermore, in the current age of rising health care costs, some of the turbinate procedures described are now performed in the office setting using local and topical analgesia. The following techniques are discussed in a sequential order, starting with techniques that generally involve the least amount of tissue removal and progressing toward techniques with more tissue resection.

Lateralization of the inferior turbinate

Lateralization of the inferior turbinate involves an outfracturing of the turbinate bone to decrease the angle with which the inferior turbinate bone projects from the maxillary and palatine bones along the lateral nasal wall (Figures 1A and 2).[11] This procedure typically begins with an infracture of the turbinate bone by placing a Boies or Goldman elevator lateral to the inferior turbinate in the inferior meatus. Force is then directed medially and superiorly in an attempt to avoid a greenstick fracture, but rather create a fracture line near the bony attachment to the lateral nasal wall (Figure 2A and B). This, in turn helps to achieve maximal lateralization when the inferior turbinate is subsequently outfractured by using the elevator to direct force inferiorly and laterally along the turbinate's attachment site to the lateral nasal wall (Figure 2C). Lateralization of the inferior turbinate is generally not considered sufficient as a stand-alone procedure for the management of significant turbinate hypertrophy, but it can be helpful when used in conjunction with other turbinate reduction procedures.[5]

Submucosal soft tissue reduction

The submucosal soft tissue of the inferior turbinate can be reduced using a variety of methods, including direct tissue resection, and various thermal techniques that produce submucosal injury (Figures 1B and 3). This leads to submucosal fibrosis and contracture, with obliteration of the venous sinusoids, and a reduction of the erectile properties of the submucosal tissue.

Submucosal electrocautery

Monopolar electrocautery and bipolar electrocautery can be used to produce submucosal thermal injury. This technique involves the use of a single needle electrode (Figure 3A), or bipolar forceps with needle tips. After the administration of local anesthetic, the electrode can be pressed against the head (anterior portion) of the inferior turbinate and activated for a short period to produce a devascularized zone. The needle electrode is then inserted into the submucosa through this zone and advanced toward the tail of the inferior turbinate while taking care to stay close to the turbinate bone. The electrocautery is then activated as the needle is slowly withdrawn to inflict the thermal injury near the tip of