SYSTEMATIC REVIEW ON THE EFFECT OF TURBINECTOMY BY LASER ABLATION AND COLD INSTRUMENTS ON NASAL OBSTRUCTION AND MUCOCILIARY CLEARANCE

(Meta-Analysis study)

For Partial fulfillment of Master Degree in
Otorhinolaryngology

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بِسْمِ اللهِ الرَّحْمنِ الرَّحِيم

قَالَ رَبِّ اشْرَحْ لِي
صَدْرِي{25} وَيَسِّرْ لِي
أَمْرِي{26} وَاحْلُلْ عُقْدَةً مِّن
لِّسَانِي{27} يَفْقَهُوا قَوْلِي{28}

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List Of Abbreviations

- OTC---------------Over the counter
- CT----------------Computerized tomography
- FDA---------------Food and Drug Administration
- SMD-------------- Submucous diathermy
- CO_2 ---------------Carbion Dioxide
- Nd Yag----------- Neodymium: yttrium-aluminum-garnet
- KTP---------------Potassium titanyl phosphate
- Ho Yag-----------Holmium:yttrium aluminum garnet
- W ----------------Watt
- kJ ---------------- kilo Joul
- Pa---------------- Pascal
- ccm--------------- cubic centimeter
- Sec ---------------second
- RevMan5 --------Review Manager 5

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Introduction

Nasal obstruction is one of the oldest and most common human complaints. Breathing well is a condition directly related to quality of life. Chronic nasal obstruction is a symptom responsible for most patients visit to otorhinolaryngologists in their daily practices. Turbinate hypertrophy and nasal septal deviation are the main causes of nasal obstruction. *(Bandos et al., 2006)*

Inferior turbinate hypertrophy is a common cause of surgically correctable nasal obstruction. No clear developmental reasons have been given for this condition. *(Neskey et al., 2009)*

However hypertrophy of the inferior turbinate is a common cause of chronic nasal obstruction, still no agreement has been reached on how to deal with this problem. A number of interventions are available for the treatment of nasal obstruction secondary to inferior turbinate hypertrophy, including immunotherapy, antihistamines, intranasal corticosteroid sprays, decongestants, corticosteroid turbinate injections, cryosurgery, electrocautery, outfracture, total or partial turbinectomy, turbinoplasty, submucous resection, radiofrequency energy tissue ablation and recently laser-assisted turbinoplasty. *(Sapci et al., 2003)*

Since the first surgical procedure for turbinate reduction, performed by Hartmann in the 1890s, many other techniques have been developed. Still none of these procedures is ideal; each is associated with known short and long-term complications. The lack of consensus about their effectiveness leaves selection of the surgical procedures up to the surgeon's personal attitude and experience. *(Passali et al., 2003)*

Aim of the study

This study will represent the use of meta-analysis to evaluate the effect of using cold instruments and laser ablation in treatment of hypertrophied inferior turbinates regarding nasal obstruction and mucociliary clearance.

Anatomy and Physiology

Relevant Anatomy and Embryology

At 8 week gestation the preturbinates are oriented in size and position comparable with the adult inferior, middle, and superior turbinates. By 9 to 10 weeks, the cartilage capsule develops into two cartilaginous flanges that penetrate the soft tissue elevations of the inferior and middle turbinate. By 15 to 16 weeks gestation, the inferior, middle, and superior turbinates are well formed. At 17 to 18 weeks gestation Initial ossification of the cartilaginous precursor of the inferior turbinate also occurs at the angle where the inferior turbinate budded from the lateral cartilaginous capsule. The development of the lateral nasal wall is close to complete by 24 weeks gestation. Based on the initial mucosal thickening, turbinate development appears to be a primary process, and meatal ingrowth occurs secondarily. *(Bingham B et al., 1991)*

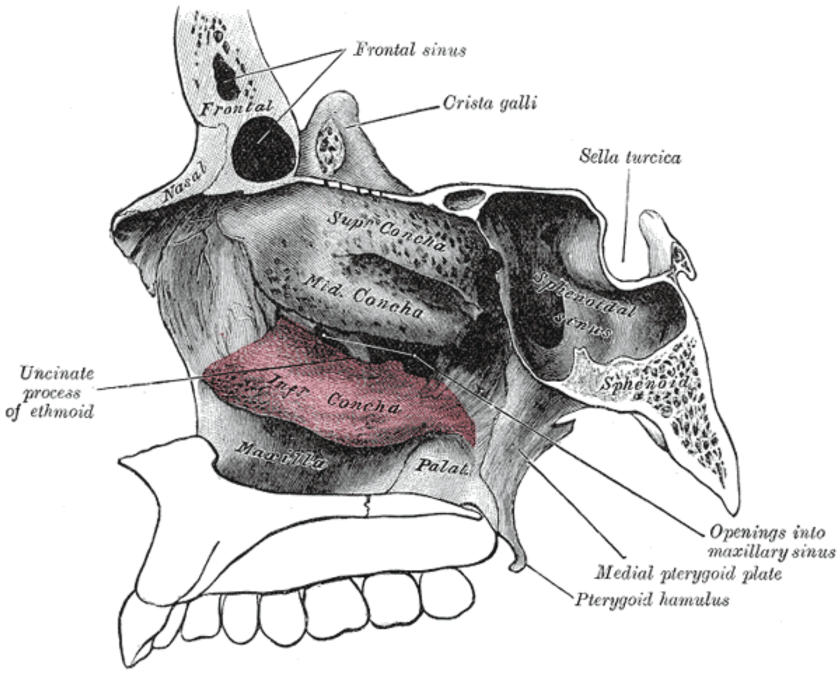
The 3 paired turbinates are located on the lateral nasal wall. The superior and middle turbinates are part of the ethmoid bone, whereas the inferior turbinates form a separate and unique bone. The inferior turbinate bone arises on the inferior portion of the lateral nasal walls. The bone itself is penetrated heavily by vascular channels, which supply the overlying respiratory epithelium. The lacrimal duct exits into the nose below the inferio-anterior portion of this structure.

The inferior nasal concha extends horizontally along the lateral wall of the nasal cavity and consists of a lamina of spongy bone, curled upon itself like a scroll. It has two surfaces, two borders, and two extremities.

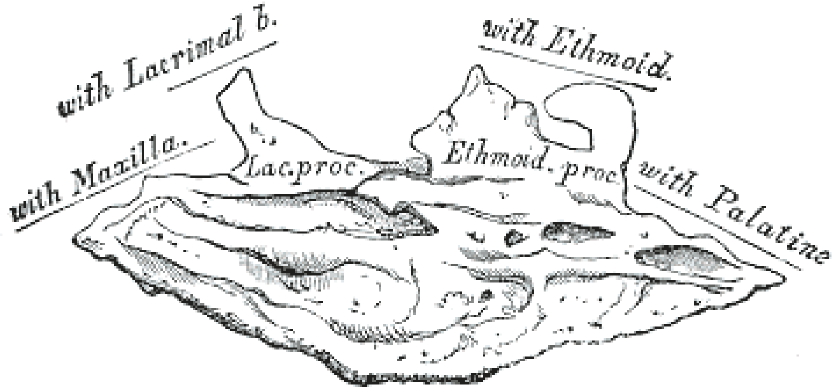
The medial surface (Fig ii) is convex, perforated by numerous apertures, and traversed by longitudinal grooves for the lodgement of vessels. The lateral surface (Fig iii) is concave, and forms part of the inferior meatus. Its upper border is thin, irregular, and connected to various bones along the lateral wall of the nasal cavity. It may be divided into three portions: of these, the anterior articulates with the conchal crest of the maxilla; the posterior with the conchal crest of the palatine; the middle portion presents three well-marked processes, which vary much in their size and form. Of these, the anterior or **lacrimal process** is small and pointed and is situated at the junction of the anterior fourth with the posterior three-fourths of the bone: it articulates, by its apex, with the descending process of the lacrimal bone, and, by its margins, with the groove on the back of the frontal process of the maxilla, and thus assists in forming the canal for the nasolacrimal duct. Behind this process a broad, thin plate, the **ethmoidal process**, ascends to join the uncinate process of the ethmoid; from its lower border a thin lamina, the **maxillary process**, curves downward and lateralward; it articulates with the maxilla and forms a part of the medial wall of the maxillary sinus. The inferior border is free, thick, and cellular in structure, more especially in the middle of the bone. Both extremities are more or less pointed, the posterior being the more tapering.

Ossification. The inferior nasal concha is ossified from a single center, which appears about the fifth month of fetal life in the lateral wall of the cartilaginous nasal capsule.

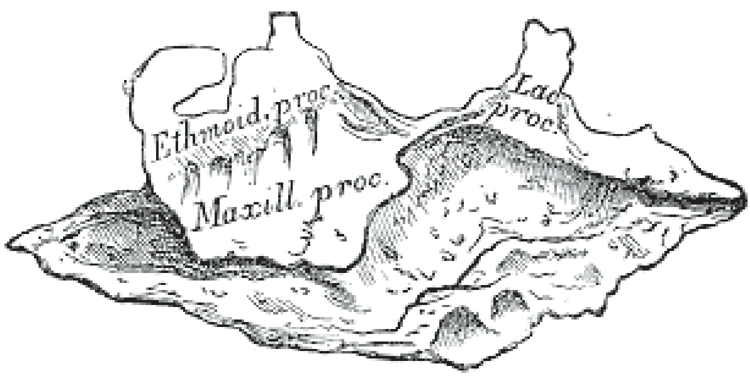
Articulations. The inferior nasal concha articulates with four bones: the ethmoid, maxilla, lacrimal, and palatine. (Fig. i) *(Gray's Anatomy 2008)*



(Fig. i) Lateral wall of right nasal cavity showing inferior concha *in situ*. *(Gray's Anatomy 2008)*



(Fig. ii) Right inferior nasal concha. Medial surface. *(Gray's Anatomy 2008)*



(Fig. iii) Right inferior nasal concha. Lateral surface. *(Gray's Anatomy 2008)*

Pathophysiology of turbinate hypertrophy

Both the blood supply and the autonomic nervous system control the secretions and level of congestion of the turbinates. The autonomic nervous system provides the general innervation to the nose, with the parasympathetic nerves supplying the resting tone and controlling secretions. The blood supply to the nose comes from branches of both the internal and external carotid artery systems. The terminal branches of the internal maxillary artery supply most of the mucosal surfaces of the nasal cavity. *(Hoover S 1987)*

The lateral nasal artery and the branches of the anterior ethmoidal artery supply the turbinates. The anterior palatine nerve from the sphenopalatine ganglion and the lateral nasal nerve provide the sensory supply to the turbinates. The parasympathetic preganglionic fibres arise from the superior salivatory nucleus and pass in the nervus intermedius to the facial nerve. At the geniculate ganglion these fibres pass through the greater superficial petrosal nerve which is joined by the deep petrosal nerve (post ganglionic sympathetic fibres) to form the nerve of the pterygoid canal (vidian nerve) and runs to the pterygopalatine ganglion. Here it synapses and postganglionic parasympathetic fibres reach the lateral nasal wall. The sympathetic fibres arise from the intermediolateral gray column of the first and second thoracic segments of spinal cord and synapse in the superior cervical ganglion. Postganglionic fibres pass to the plexus around the internal carotid artery and then through the deep petrosal nerve to the vidian nerve. *(Seema S et al., 2006)*

Similar to the rest of the upper respiratory tract, the membranes of the turbinates are composed of ciliated, pseudostratified, glandular, columnar epithelium. The cilia beat in unison to propel the mucus from the nasal cavity toward the nasopharynx, where the mucus can then be swallowed. Mucociliary transport relies on mucus production and ciliary function. Normally, the nose and paranasal sinuses produce approximately 1 quart (about 1 liter) of mucus in a 24-hour period. When inflamed, that amount can be more than double. Mucus contains immunoglobulin A (IgA), immunoglobulin E (IgE), and muramidase. *(Naclerio RM et al., 2007)*

The submucosa contains large numbers of secreting glands. The submucosa of the inferior turbinate contains mainly serous glands, while that of the middle turbinate contains mucus glands. The mucus membrane covering the middle and inferior turbinate contain additional venous sinusoids located between the capillaries and venules. The sinusoids are surrounded by smooth muscle fibers which are controlled by the autonomic system. These are able to vasodilate or vasoconstrict depending on the physiologic demands of the body. *(Mathai J 2004)*

The ciliated epithelium is highly active and beats to move the mucosal film towards the nasopharynx, filtering out particles suspended in the inspired air. The important functions of the nose include:

- Airway.
- Olfaction
- Antibacterial activity
- Air conditioning
- Reflex functions
- Resonance