The Mechanics of Rhinological Disease

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The Airways
- an epithelial continuum

The epithelium is ciliated, vascular, rich in mucus producing glands.
THE EXTERNAL NASAL VALVE

The *external nasal valve* is the space between the *nasal ala* laterally and the *septum* medially; it is compliant and liable to *collapse* from the negative pressures of inspiration. It is opened by activation of the dilator nares muscles.

*Patency of the E.N.V. is not determined by the vascular status of the tissues.*

During expiration, positive pressure keeps the nasal vestibule open.
THE INTERNAL NASAL VALVE

- The *internal nasal valve* is the space between the *upper lateral cartilages* and the front ends of the *inferior turbinates*.
- This is the *narrowest part* of the nose approximately 1.3 cm from the naris.
- *Nasal resistance* at this level is a function of the compliance of the structural nasal tissues, and especially of the *vascular status of the mucosa*.
The nasal fossa

- Low resistance cavity whose volume varies depending on the degree of *turbinate engorgement*
- Inferior / middle / superior *turbinates* are paired lateral vascular structures
- The *septum* is a bony / cartilaginous midline partition between the two sides
- The *olfactory nerves* occupy the vault of the nasal fossa
The nasopharynx

- Cavity posterior to the nasal fossa
- Contains **adenoid** vegetations
- Communicates laterally with the middle ears via the **Eustachian tube**
- Communicates inferiorly with the oropharynx
- Site for (often occult) **malignancy** which may present as either **nasal obstruction**, or **Eustachian dysfunction**
The paranasal sinuses

- Paired spaces opening into the nasal fossa via a middle meatal ostium
- **Ciliary beat** propels mucus towards the ostium
- Nasal inflammation causes obstruction of the ostium leading to pansinusitis
- Ethmoids are the site of origin for polyps
- Sinuses are sometimes the site for occult malignancy presenting with dental or orbital symptoms
Nasal Physiology

Air Filtration - the vibrissae, nasal mucus
Humidification - blood flow and mucus
Heat exchange - the nasal mucosa blood flow runs counter to the airflow
Immune defenses - normal mucociliary flow, lymphatic tissue
Voice modulation - sino-nasal aerodynamics
Olfactory system - nasal aerodynamics
Neur.vasc.reflexes - sneezing, the nasopulmonary reflex

The nasal cycle creates an intermittent functional extreme by turbinate congestion alternately between right and left every 3 hours.
Nasal resistance is important for respiratory physiology. Automatic positive end-expiratory pressure is maintained by the resistance encountered during expiration.

- Factors decreasing nasal resistance: exercise, sympathomimetics, the erect posture
- Factors increasing nasal resistance: rhinitis, supine posture, alcohol, aspirin, ACE inhibitors
The Nasal Balance

- Resistance is the product of neural sympathetic and parasympathetic interaction, with hormonal and also central neural modulation

- The balance is exquisitely delicate but dependant on environmental factors
The Nasal Balance?

Our Brave New World has produced wealth, smog, stress and (blocked noses)
Nasal and paranasal symptoms

- Obstruction
- Rhinorrhoea
- Sneezing
- Epistaxis
- Otitis media with effusion
- Headaches and facial pain
Obstruction as a presenting complaint in a rhinology clinic

- 68% of all new patients complained of only a blocked nose
- 32% of patients also complained of rhinorrhea and sneezing
- 62% of patients with a blocked nose needed surgery
CAUSES OF NASAL OBSTRUCTION

- **Mechanical**: septal deviation, valvular collapse, turbinate hypertrophy, choanal atresia, tumours
- **Inflammatory**: allergic rhinitis, polyposis, vasomotor rhinitis / nasal hyper reactivity, sinusitis
- **Drug induced**: rhinitis medicamentosa, ACE inhibitors (Lisinopril)
- **Iatrogenic**: Rhinoplasty, Empty Nose syndrome
Sites of nasal obstruction

- **External valve**: valve collapse due to softened cartilage
- **Internal valve**: septal deviation, swollen inferior turbinates,
- **Nasal fossa**: septal deviation, turbinates polyps, tumours,
- **Nasopharynx**: adenoids, tumours, choanal atresia
- **Sinuses**: chronic sinusitis, tumours
The ages of nasal obstruction

- **Neonates**: choanal atresia
- **Infants**: unilateral choanal atresia, nasal hypereactivity
- **Children**: adenoids, allergy
- **Adults**: adenoids (rarely), deviated nasal septum, nasal allergy and hyperreactivity, polyps, tumours
- **The elderly**: external valve collapse
Rhinitis

- Allergic seasonal - often pollen-induced, usually acute

- Allergic perennial – usually secondary to exposure to moulds, housedust mites, animal danders, often chronic

- Nasal hyperreactivity / vasomotor rhinitis usually chronic
Symptomatology

- **Seasonal**: paroxysmal sneezing, rhinorrhea, obstruction
- **Perennial**: rhinorrhea, obstruction, sneezing
- **Hyperreactivity**: obstruction, sneezing
# The medication profile

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Medication protocols

Mild intermittent AR : Antihistamine
Severe intermittent AR : AH / steroid spray

Mild persistent AR : AH / steroid spray
Severe persistent AR : AH / steroid spray
Ipratropium spray
oral steroids
Patient satisfaction

- The ideal treatment: one tablet taken once and never again
- Patient compliance is very variable and intermittent, but probably never more than 25 – 35%
- Rhinorrhoea / sneezing probably easier to treat
- Obstruction of established hyperreactivity is the most difficult to treat and usually requires surgery
Nasal polyps

- Oedematous ethmoidal mucosa, less often maxillary
- Severe nasal obstruction, anosmia, often secondary infection
- Treatment is medical – longterm topical steroids / intermittent oral steroids
- Surgery reserved for very bulky polyps
Nasal hyperreactivity

- Parasympathetic overdrive leads to progressive turbinate hypertrophy and paroxysmal sneezing
- May be post-viral
- Urban phenomenon probably related to air pollution
- Responds with difficulty to steroid spray
- Often requires surgery
Acute sinusitis

- Intense inflammation of sinus mucosa often allergic in origin
- Secondary infection as a result of stasis
- Can sometimes result in serious intracranial infection
- Treatment requires a judicious combination of antihistamines, antibiotics, decongestants, steroids
Subacute / chronic sinusitis

- Usually associated with allergic rhinitis
- Poor ventilation may be worsened by coexisting septal deviation
- Long history of nasal obstruction, rhinorrhea, facial pains, headaches
- Hypertrophic mucosa can become polypoid
- Often requires endoscopic surgery
Rhinological surgery

- Almost always directed at \textit{reducing} obstruction and \textit{improving} sinus ventilation and \textit{drainage}

- Turbinate surgery may help reduce the population of mast cells and so reduce severity of allergic rhinitis
Does nasal surgery work?

Oh yes!
Nasal polyps will always recur after surgery – topical steroids are mandatory.

Grossly swollen turbinates need surgical volumetric reduction, e.g. partial turbinectomy; cautery alone is not enough.

Septoplasty often requires additional contralateral turbinate reduction.
The procedures

- Septoplasty
- Volumetric reduction of the turbinate – resection, cautery, radiofrequency
- Nasal polypectomy – microdebrider
- Functional endoscopic sinus surgery – microsurgical procedures using rigid telescopes aimed at improving the patency of the natural ostium
Microdebriders
Uncinectomy
Before and after FESS