



Treatment Updates

Loss of Smell (Anosmia)

INTRODUCTION

The sense of smell largely determines the flavour of food and beverages and serves as an early warning system for the detection of environmental hazards. This primary sensory system contributes significantly to one's quality of life allowing for the full appreciation of flowers, perfume, spices and a vast array of food and beverages. Thus it is little wonder that loss or alteration of smell sensation is of considerable significance to patients, particularly those dependent on their sense of smell for their livelihood or safety.

ANATOMY AND PHYSIOLOGY

In humans three specialised neural systems are present within the nasal cavities: 1) the main olfactory system (olfactory nerve or cranial nerve I), 2) the trigeminal somatosensory system (trigeminal nerve or cranial nerve V) and 3) the nervus terminalis.

The olfactory nerve mediates odour sensation whereas the trigeminal nerve mediates through both chemical and non-chemical stimuli, somatosensory sensations including those of burning, cooling, irritation, tickling and pain.

The function of the nervus terminalis is unknown in humans (in rodents it seems to contribute to reproductive behaviour). Despite the fact that nearly all adult humans possess, in the lower recesses of each nasal cavity, a rudimentary vomeronasal (Jacobson's) organ no function has been determined for this.

OLFACTORY NEUROEPITHELIUM

The olfactory neuroepithelium, which harbours the main sensory receptors in the olfactory system, is limited to a small part high up in the nose. It occurs on the upper septum, cribriform plate, superior turbinate and the upper margin of the middle turbinate. Hence any disruption of inspiratory airflow can interfere with penetration of odour of substances.

The olfactory epithelium comprises six distinct cell types. The first are the bipolar sensory epithelial neurones of which there are approximately 6,000,000. The olfactory receptors are located on the ciliated dendritic ends of these cells. The receptor cell axons coalesce into approximately 40 bundles called the olfactory fila, which are sheathed by Schwann-like cells. The fila traverse the cribriform plate of the ethmoid bone to enter the anterior cranial fossa and collectively constitute the olfactory nerve.

The second cell type of which there are approximately 600,000 are known as the microvillar cells.

The third cell type are the supporting or sustentacular cells which are important in insulating receptor cells one from the other, deactivating odorants and irritants and have an important protective role with regards to the neuroepithelium.

The fourth cell types are the cells that line Bowman glands and ducts. These structures are the major source of mucous within the olfactory epithelium.

The fifth and sixth cell types are basal cells, which are called light and/or dark cells. They exhibit enormous polypotential in being able to differentiate not only into any type of cell in the neuroepithelium but also into a large number of other cell types. There are approximately 1000 classes of odour receptors on the cilia of the olfactory receptor cells.

OLFACTORY BULB AND CORTEX

The olfactory bulb is a complex processing centre receiving both afferent and efferent input. This ovoid structure is where the nerve endings coming through the olfactory fila to constitute the olfactory nerve synapse.

The major second-order neurones of the olfactory bulb project their axons centrally into elements of the olfactory cortex. The olfactory cortex comprises; 1) the anterior olfactory nucleus, 2)



the olfactory tubercle, 3) the prepiriform cortex, 4) the lateral entorhinal cortex, 5) the periamygdaloid cortex and 6) the cortical nucleus of the amygdala. Olfaction is unique in that information from the olfactory bulb goes directly to cortical structures without passing through the thalamus.

Loss of smell is called anosmia, reduction in a sense of smell is called hyposmia and the sensation of foul smell is called cacosmia.

CAUSES OF ANOSMIA

HEAD INJURY

- The severity of head injury can be from major to minor. Damage to the olfactory bulb can occur with or without damage to the cribriform plate. Alteration of the sense of smell is associated with approximately 10% of major head injuries.

SURGERY

- Cranial surgery and intranasal sinus or transphenoidal surgery can be associated with loss or alteration in sense of smell.

INFECTION

- Rhinosinusitis can damage the olfactory neuroepithelium. Damage is more likely with chronic sinus infection than with an acute infection.
- Long term use of nasal sprays particularly sympathomimetic amines have been shown to be associated with alteration in sense of smell.

MEDICAL CONDITIONS

- Kallmann's Syndrome is a genetically determined syndrome associated with failure to develop olfactory bulbs resulting in congenital anosmia.
- Psychological/psychiatric conditions can affect smell perception, for example depression, hysteric conversion reactions, schizophrenia.
- Meningitis, especially in infancy.
- Temporal lobe epilepsy.
- Sjogren's Syndrome.
- The sense of smell deteriorates with age.

MEDICATION

- Long term use of nasal sprays.
- Antibiotics such as Metronidazole, Ciprofloxacin or Cefuroxime.
- Zythromax
- Drugs such as Amitriptyline.
- ACE inhibitors.
- Radiation therapy of the head and neck.

CHEMICALS

- Chemical exposure can cause mechanical damage to the olfactory epithelium.
- Cleaning agents such as ammonia with a strongly alkaline pH are very toxic to neuroepithelium.
- Irritants – cigarette smoke interferes with one's ability to smell essentially due to drying of the nasal mucosa and also direct toxic damage to the neuroepithelium.

SINUS PROBLEMS, OTHER INTRANASAL CAUSES

- Deviated nasal septum.
- Crooked nose.
- Significant nasal obstruction due to allergic or inflammatory conditions.
- Benign nasal tumours such as nasal polyps.
- Malignant nasal tumours.
- Some pituitary tumours extending into the nose.

DIAGNOSIS

A complaint of altered or loss of sense of smell should be taken seriously. The first thing to do is to examine the nose thoroughly to see if there is adequate nasal airflow or if there is nasal obstruction (particularly unilateral).

Medical evaluation involves a complete medical history and physical examination, full blood count is indicated including haemoglobin, white cell count, ESR and renal function tests.

If the cause of altered sense of smell or taste is not apparent Otolaryngological consultation is important. An Otolaryngologist will examine the nose after topical vasoconstriction via Nasendoscopy, to see if there are any intranasal lesions present, to directly examine the olfactory cleft, rule out intercurrent rhinosinusitis, and may contemplate doing a biopsy of the olfactory neuroepithelium under local anaesthesia. If appropriate, organise imaging (either CT scan or MRI scan) to assess the nose and paranasal sinuses, the olfactory cleft, the cribriform plate and the olfactory cortex.

OLFACTORY TESTING

The most commonly used tests for assessing olfactory are the odour threshold and odour identification tests.

Olfactory threshold testing

The lowest concentration of an odour that can be readily detected is termed the **detection or absolute threshold**. In olfactory threshold



testing the subject is asked to report which of two or more stimuli smells strongest. Such "forced choice procedures" are less susceptible to contamination by response bias than "non-forced choice procedures". A commercially available smell threshold test is available based on concentration of phenyl ethyl alcohol ranging from 10⁻² to 10⁻¹⁰ log volume/volume in half long concentration steps is available from the Sensonic Company.

Normative data is available with the test kits.

Odour Identification Testing

In terms of Odour Identification Testing the University of Pennsylvania Smell Identification Test (UPSIT) comprises four booklets of 40 specific odorants. Each page contains a micro encapsulated odorant that is released by means of a pencil tip. This test which has been administered to approximately 200,000 patients since its development is the most widely used olfactory testing system in the world and is commercially known as the Smell Identification Test.

TREATMENT

Treatment of altered sense of smell obviously depends on the diagnosis.

Viral upper respiratory tract infection

Following a viral upper respiratory tract infection without intercurrent persisting rhinosinusitis; nasal decongestants ± trial of oral steroids is recommended.

Chronic sinusitis

Associated with altered smell; long course of appropriate antibiotics, nasal decongestants, normal saline douches. A pulse of oral steroids is an accurate predictive test. If smell returns while on steroids prospect for the return of smell is good. If smell does not return with a pulse of oral steroids the prospect of return to smell is poor.

Structural abnormalities

Structural abnormalities in the nose associated with altered smell are usually treated surgically. The most common surgeries are Nasal Septal Reconstruction plus or minus judicious Endoscopic Sinus Surgery.

Tumours in the nose

Associated with altered smell; the most common nasal tumours are benign nasal polyps and again steroid pulse predictive index is high. Appropriate management for nasal polyposis usually involves

judicious surgery associated with lifelong follow-up and appropriate adjuvant medical therapy.

Post traumatic hyposmia or anosmia

Post traumatic hyposmia or anosmia is usually associated with a poor outcome. Correction of cranial cribriform plate fractures usually does not lead to improvement and/or return of sense of smell.

Anosmia associated with allergy

Again the steroid predictive index test is accurate. Appropriate management of the nasal allergy by way of intranasal low dose water based steroid sprays/decongestants/normal saline douches plus or minus appropriate desensitisation helps improve penetration to the area of the olfactory cleft and if the steroid predictive test indicates the olfactory neuroepithelium is intact, long term results in terms of restoration of sense of smell are good.

Idiopathic anosmia

Idiopathic anosmia, that is to say the loss or alteration of smell in adult life not associated with mechanical problems in the nose, intercurrent rhinosinusitis and/or allergy is usually associated with a poor outcome. Zinc, copper and other trace elements have occasionally been used. The evidence of their efficacy is weak.

**If further information is required,
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